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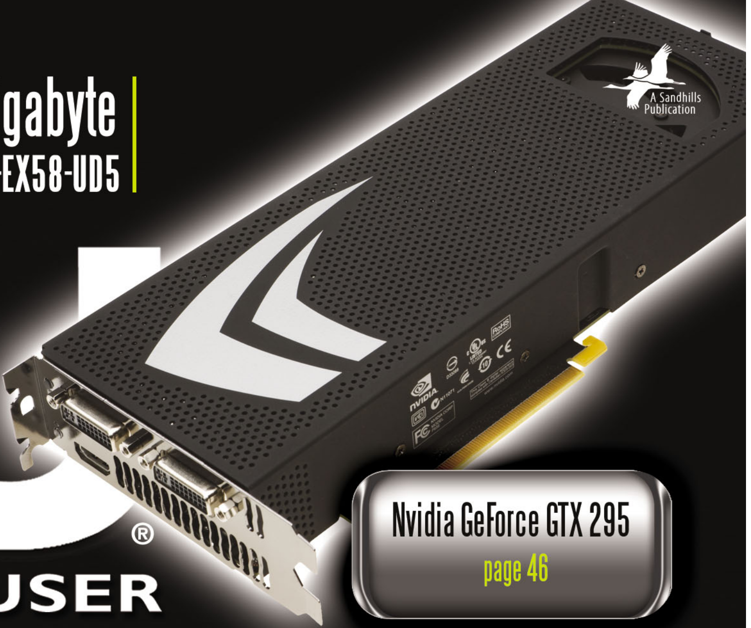

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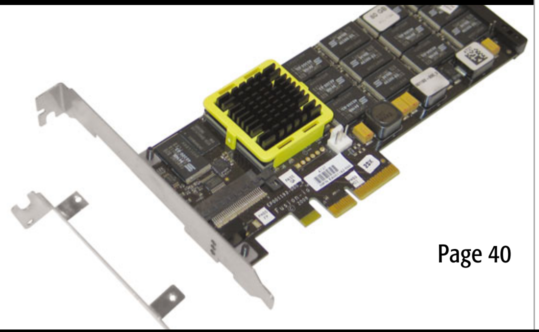

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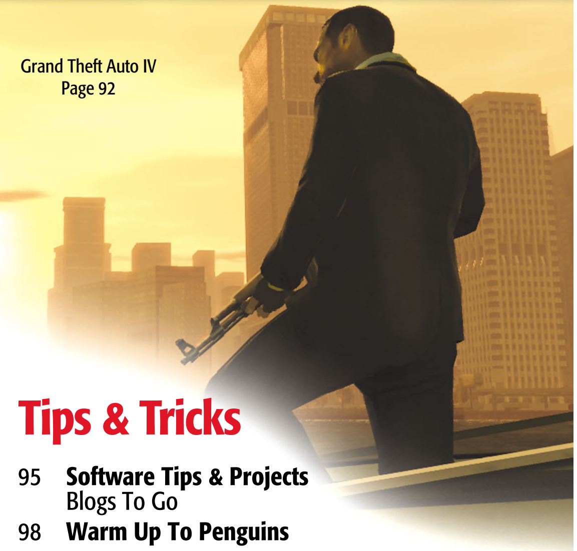

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EDITOR'S NOTE

It seems 2009 is in full swing. In this issue alone, we take a look at major new hardware releases from AMD and Nvidia, and there are more coming that we can't even tell you about yet. (You'll probably know about some of them by the time you read this.) Your options for upgrades and/or new builds are fairly staggering, and it feels like the industry is just warming up.

Whether you're prepping for a build right away or are just scouting ahead a bit, you'll find a good chunk of the intelligence you need to plan effectively in this issue. In addition to our big motherboard extravaganza, starting on page 62, is only the beginning. You'll also find roundups of NAS boxes (page 19), cases (page 28), and video cards (page34), including the latest monster card from Nvidia, the GTX 295.

We also got to take a look at Fusion-io's most excellent ioDrive (page 40), the flash storage unit that nestles in a PCI-E slot and provides DRAM-like access to hard drive-esque quantities of data. This, of course, is beyond the scope of all but the barest few PC builds, thanks to its cutting-edge price tag, but it sure is fun to look, isn't it?

And while we're on the subject of general tech curiosity, be sure and hit pages 82-84 for a look at what's going on with distributed computing programs such as Folding@Home, SETI@Home, and the like, and check out our chat with Henry Tirri, the head of the Nokia Research Center, on how the ubiquity of cell phones combined with newly affordable sensors is going to change the way you get all sorts of useful information in the near future.

All of that (plus our annual Game of the Year awards) is packed into the mag you're currently holding, so settle in, put your feet up, and enjoy.

Chris Trumble, Publication Editor, *CPU*

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What's Happening • Hardware

Compiled by Blaine Flamig

HotHardware.com Releases Bargain-Worthy Overclocking Guide

As HotHardware.com put it, "in this economic environment, price is a major factor for most people out there, and lots of people out there are looking for a bargain, or at least, something to make the price tag more tolerable." To that end, HotHardware.com recently presented its guide to "Overclocking Intel's Core i7 920 Processor." The usual tests and benches are present, but also included are details on how HotHardware.com took a stock 2.66GHz budget-priced 920 (about $300) and clocked it to 4GHz and stably ran it at 3.9GHz using a Thermaltake V1 AX (about $59.99) for cooling. "You can get substantially higher clock speeds compared to what Intel has on the market today, heavily outpacing the $1,000 Core i7 Extreme Edition chip at 3.2GHz," HotHardware.com states. The site does warn upgrades necessary to move to a Core i7 base could easily total $750. ▲

Raise Your Glass To IBM Tech Pioneer Jack Kuehler

Jack Kuehler, the man largely credited with building IBM into the behemoth it would become in the 1980s and beyond, died in mid-December at age 76. As the many who paid tribute to Kuehler following his death noted, the electrical engineer started with Big Blue in the late 1950s, ultimately becoming the highest-ranking technologist at the company. During stints as senior vice president, vice chairman, and president, Kuehler helped develop the open-standards PC workstation platform IBM is now synonymous with and was also instrumental in supporting a struggling Intel early on, helping create Sematech, and developing the alliance that would create the PowerPC for Apple systems. ▲

There's Still Life In The Ol' Girl

Tucked down deep within the scads of lists contained in Nielsen's Top 10 Lists For 2008, covering everything from TV to music to consumer purchasing trends, you'll find an interesting chart called Video Game Console Usage. Surprisingly, it's none other than the PlayStation 2 sitting atop the heap, having amassed 31.7% of the total console user minutes logged for the year. Following the aged but popular PS2 is the Xbox 360 (17.2%), upstart Wii (13.4%), Xbox (9.7%), PlayStation 3 (7.3%), and GameCube (4.6%). Elsewhere, World of Warcraft members will be interested to know that Nielsen states Warcraft players totaled 671 average minutes played per week in 2008. Yikes. ▲

The Changing Face Of Notebooks

The calendar had just turned 2009 at press time, but already a buzz concerning new notebooks was in the air, including word about a 17-inch Lenovo ThinkPad W700ds (starting at $3,663) that sports a secondary 10.6-inch slide-out display, a trait the Voodoo Firefly also shares. Although still a prototype, the Firefly is said to have enough muscle to "tear through" Far Cry 2. Elsewhere, LG was set to show a 14.1-inch prototype laptop at CES with a display that it says works as equally well indoors as outdoors using backlight and reflective modes. MSI, meanwhile, recently launched its U115 Hybrid, hailed as the world's first notebook "capable of operating both SSD and HDD hard drives simultaneously." An Eco mode, in fact, can shut down the U115's hard drive while the SSD keeps on rolling. ▲

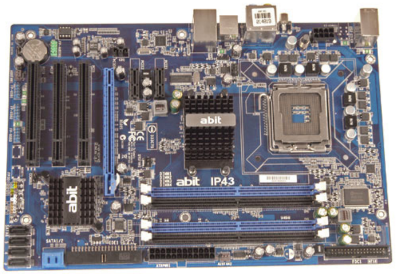
Speaking Of New Notebooks . . .

In December, Acer detailed the nicely priced (about $1,800) Aspire 8930G-7665, an 18.4-inch (1,920 x 1,080) quad-core gaming notebook running Nvidia GeForce 9700M GT graphics but more notably Intel's new Core 2 Quad Mobile Processor Q9000. Though Intel hadn't officially confirmed the Q9000 (or four other new mobile CPUs it reportedly launched), Acer stated such specs as four Core 2 cores, 6MB shared L2 cache, and up to 2GHz speeds. Elsewhere, details concerning AMD's upcoming quad-core Phenom II processor, which AMD had planned to unveil at CES, leaked early when pre-orders from retailers showed up online. The CPU is rumored to run between 2.8 and 3GHz, though liquid nitrogen-aided overclocks reportedly have netted 5GHz-plus speeds. Finally, various reports have Via working on the dual-core Nano 3000, a would-be energy-efficient mobile competitor to Intel's Atom, rumored for late 2009 or beyond. ▲

HARDWARE MOLE

Has Abit Sold Its Last Motherboard?

If your hardware closet looks something like ours, there are probably one or two motherboards from Abit stacked among the clutter. If so, it's time to pay respect, as the long-time motherboard maker reportedly closed its doors to producing motherboards as of Dec. 31, 2008, due to cost-cutting measures from parent company Universal Scientific Industrial, which bought Abit in 2006. Several online sources quoted Fernando Cobreros Benito, an Abit sales manager, as saying, "Abit will definitely continue to manufacture products" although "these will not be motherboards." USI reportedly will honor Abit motherboard warranties for up to three years. ▲



HP Gives Mixed Mac & PC Homes A Multimedia Server

More homes than ever now have a mix of PCs and Macs working on various tasks, including storing massive amounts of multimedia files. HP aims to unify such environments with its recently revamped 750GB EX485 ($599) and 1.5TB EX487 ($749) MediaSmart Server models, each of which "automatically backs up both Windows PCs running Microsoft's Windows Home Server Backup and Apple Macs using Apple's Time Machine software." Although initial configuration requires a Windows system, Mac and Windows users can back up files, access shared folders, access data via the Internet, use HP Photo Publisher to upload photos online, and centralize iTunes libraries so they're available to any networked computer with iTunes installed. Look for the servers in February. ▲

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(1066Mhz FSB)

T9600 6MB L2 Cache, 2.80Ghz	$ 1239
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P8600 3MB L2 Cache, 2.40Ghz	$ 929
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4GB DDR-II PC6400 800 Memory, 320GB SATA150 Hard Drive
15.4" WXGA TFT Display 1280x800 pixels
8X DVD+/-RW Drive, 1000/100/10 Network, 56K V.92 Fax/Modem
NVIDIA® GeForce® Go 9600 GT 512MB
4-in-1 Built-in Media Reader, 1 IEEE-1394 Firewire Port,
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Weight only 6.8 Lbs, Free Carrying Case, 6 Custom Colors to Choose From

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Compiled by Blaine Flamig

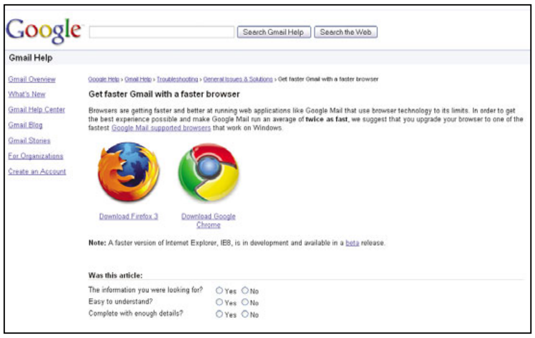
"This Web Site Has Been Rated R"

Peeved off Web users all but led Australian officials to the gallows recently after word concerning a proposed Web filter that would block 1,300 Web sites surfaced. Britain's Culture Secretary Andy Burnham met a similar reaction after he told *The Daily Telegraph* he feels a film-like ratings system for Web sites is in order, as there's content "that should just not be available to be viewed." Burnham insisted his aim is to better define "where the public interest lies and being clear about it." Although the Internet has been "empowering and democratizing in many ways," he stated, "leaving your child for two hours completely unregulated on the Internet is not something you can do." Other possibilities, Burnham stated, include age limits and working with President Barack Obama's administration on creating international rules. ▲

Google Calls Out IE—Sort Of

Mozilla CEO John Lilly recently stated he'd "be lying if I said that things weren't more complicated than they used to be" with Google following the launch of Chrome, which Google recently made the default browser choice in its Google Pack in favor of Firefox.

Google, meanwhile, began recently notifying Gmail users on a support page that "browsers are getting faster and better at running Web applications like Google Mail that use browser technology to its limits." To "make Google Mail run an average of twice as fast," Google suggested users upgrade to "one of the fastest Google Mail supported browsers that work on Windows," supplying huge download icons for Firefox 3 and Chrome. Although it mentions the "faster" IE8 beta, Google relegates Safari 3.0 and IE7 to "fully supported" browser status—although on a separate support page and without gigantic icons. ▲



Google Help › Gmail Help › Troubleshooting › General Issues & Solutions › Get faster Gmail with a faster browser

Get faster Gmail with a faster browser

Browsers are getting faster and better at running web applications like Google Mail that use browser technology to its limits. In order to get the best experience possible and make Google Mail run an average of **twice as fast**, we suggest that you upgrade your browser to one of the fastest Google Mail supported browsers that work on Windows.

Note: A faster version of Internet Explorer, IE8, is in development and available in a beta release.

Was this article:

The information you were looking for? ○ Yes ○ No
Easy to understand? ○ Yes ○ No
Complete with enough details? ○ Yes ○ No

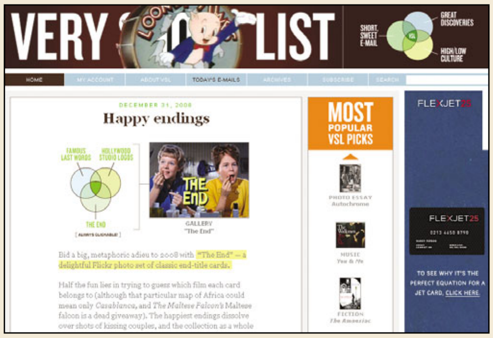
RIAA Abandons Lawsuits, Hopes To Enlist ISPs' Help

Christmas came days early for RIAA opponents in mid-December following a *Wall Street Journal* article stating the RIAA is ending its lawsuit campaign originated in 2003 to thwart illegal online music sharing. Instead of lawsuits, the RIAA will now reportedly seek help from ISPs in warning heavy music traffickers to stop or potentially lose Web access. Fred von Lohmann, an Electronic Frontier Foundation attorney, stated "The campaign has been, by any measure, a failure. The lawsuits have not reduced unauthorized file-sharing and have not gotten a single artist paid." ▲

SIGHT SEEING

Very Short List Compiles Very Good Entertainment

If you haven't added VeryShortList.com to your own list of keeper Web sites, do so. Kurt Andersen, author, host of Public International Radio's "Studio 360," and *Spy* magazine co-founder, helped create Very Short List, which combs the Web for "excellent and fascinating stuff" worthy of sharing and discussing. Subscribe and VSL sends one "very short, very free" email each workday in three categories, including Very Short List ("excellent [and sometimes vintage] entertainment and media that haven't been hyped to within an inch of their lives"), Science ("keeps you up-to-date on the breakthroughs that don't necessarily make the front page"), and Web ("entertaining nuggets and indispensable tools"). Food, Books, and Kids categories are coming soon. ▲



Bid a big, metaphoric adieu to 2008 with "The End" — a delightful Flickr photo set of classic end-title cards.

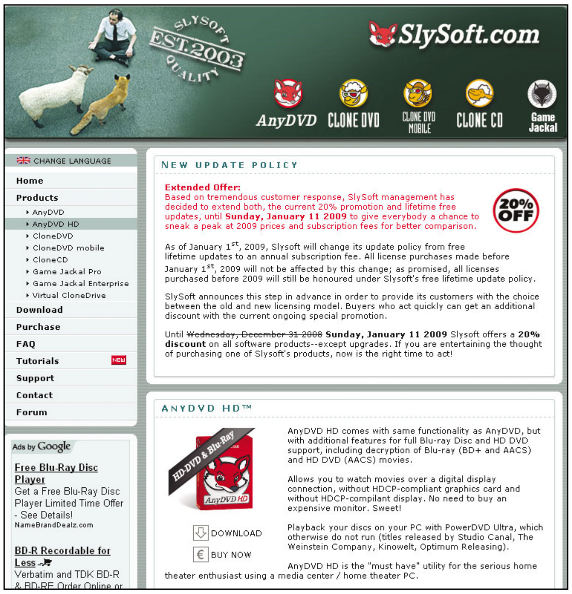
Half the fun lies in trying to guess which film each card belongs to (although that particular map of Africa could mean only *Casablanca*, and *The Maltese Falcon's* Maltese falcon is a dead giveaway). The happiest endings dissolve over shots of kissing couples, and the collection as a whole

CallingAmerica.com Puts The Web In VoIP

Here's the 411 on CallingAmerica.com: This Web-based VoIP service from Goober Networks is "the first free, no-hassle, completely Web-based online destination that lets anyone with a broadband connection place unlimited VoIP calls to any landline or mobile phone in the U.S. or Canada." Supplying a mic, speakers, or headset is on you, and you'll also have to sit through a short ad before placing your call in order to offset calling costs. Registering an account, however, lets you make unlimited calls that span 15 minutes each. Elsewhere, Goober Networks is also at work on Goober Messenger, "the first universal messaging platform to enable chat, VoIP, and video communication via an embedable widget." ▲

Compiled by Blaine Flamig

SlySoft Gives BD+ A Good Cracking—Again



NEW UPDATE POLICY

Extended Offer:
Based on tremendous customer response, SlySoft management has decided to extend both, the current 20% promotion and lifetime free updates, until **Sunday, January 11 2009** to give everybody a chance to sneak a peak at 2009 prices and subscription fees for better comparison.

As of January 1st, 2009, Slysoft will change its update policy from free lifetime updates to an annual subscription fee. All license purchases made before January 1st, 2009 will not be affected by this change; as promised, all licenses purchased before 2009 will still be honoured under Slysoft's free lifetime update policy.

SlySoft announces this step in advance in order to provide its customers with the choice between the old and new licensing model. Buyers who act quickly can get an additional discount with the current ongoing special promotion.

Until ~~Wednesday, December 31 2008~~ **Sunday, January 11 2009** Slysoft offers a **20% discount** on all software products--except upgrades. If you are entertaining the thought of purchasing one of Slysoft's products, now is the right time to act!

ANYDVD HD™

AnyDVD HD comes with same functionality as AnyDVD, but with additional features for full Blu-ray Disc and HD DVD support, including decryption of Blu-ray (BD+ and AACS) and HD DVD (AACS) movies.

Allows you to watch movies over a digital display connection, without HDCP-compliant graphics card and without HDCP-compilant display. No need to buy an expensive monitor. Sweet!

Playback your discs on your PC with PowerDVD Ultra, which otherwise do not run (titles released by Studio Canal, The Weinstein Company, Kinowelt, Optimum Releasing).

AnyDVD HD is the "must have" utility for the serious home theater enthusiast using a media center / home theater PC.

Free Blu-Ray Disc Player
Get a Free Blu-Ray Disc Player Limited Time Offer - See Details!
NameBrandDealz.com

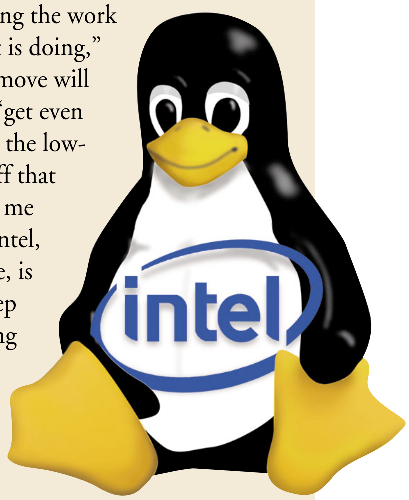
BD-R Recordable for Less
Verbatim and TDK BD-R & BD-RE Order Online or

SlySoft, creator of AnyDVD HD and "renowned for promoting Fair Use Rights," tipped the scales in its war with Hollywood back in its favor in December 2008, announcing it had "defeated BD+ once again," despite previously not expecting to crack Macrovision's BD+ security technology until February. SlySoft says AnyDVD HD 6.5.0.2 (about $110) now "decrypts copy protection on all current Blu-ray movies" and "ensures that consumers may continue to back up and enjoy their Blu-ray movie purchases even when using computer monitors that are not HDCP-compliant." The fight with Hollywood may be taking a toll, however, as SlySoft changed its free lifetime-updates policy to an annual subscription fee starting Jan. 11. ▲

Microsoft Endures Bumpy End To 2008, But Are Layoffs Coming?

Microsoft was in the news up through 2008's last moments, as it not only saw copies of what's anticipated as the upcoming public Windows 7 beta leaked and torrented across the Internet's seven seas, but also thousands of 30GB Zunes going dark Dec. 31 due to a leap year-related software glitch. Although a full battery charge reportedly returned most Zunes to order Jan. 1, the bad vibes kept rolling in 2009's opening days as rumors concerning Microsoft laying off upwards of 15,000 employees (a whopping 17% of worldwide operations) gained considerable steam. Reports placed the layoffs as happening around Jan. 15 when MS' Q2 earnings report was due. Fudzilla, meanwhile, reported "staff at Microsoft has been informed that the company is readying major layoffs to its worldwide operations, and it's not a small cut, either." ▲

Linux Kernel Developer Departs Red Hat For Intel



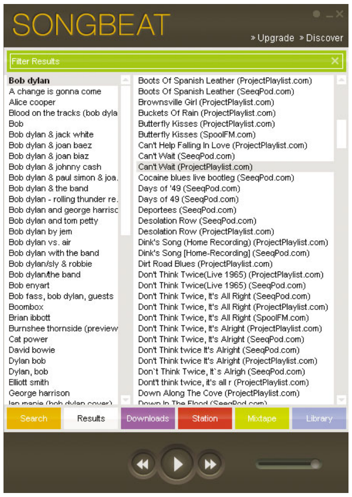
After a decade at Red Hat, noted British Linux kernel developer Alan Cox announced in late December he was taking a position within Intel's operating system division effective mid-January. In a statement to LXer (www.lxer.com), Cox stated he left Red Hat on good terms and "strongly supporting the work Red Hat is doing," but the move will let him "get even closer to the low-level stuff that interests me most." Intel, of course, is knee-deep in helping shape the open-source Linux Moblin platform and has reportedly hired numerous employees recently with open-source ties. The Linux Foundation, meanwhile, named Ted Tso, an IBM veteran regarded as the first North American developer of the Linux kernel, as its new CTO, replacing Markus Rex of Novell. ▲

SOFTWARE SHORTS

Mac OS X Market Share Rises At Fastest Clip Ever

On the heels of online reports that Apple was preparing to announce cloud versions of the apps in its iWork suite, as well as iMovie from iLife, at January's MacWorld came data from Net Applications that Mac OS X's market share climbed to 9.63% in December 2008. That's up from 8.9% for November and 7.3% for 2007. The 1.4% total increase for November-December tops the previous two-month record of 0.9% that Net Applications reported during September and October 2006. Windows' share, meanwhile, experienced its worst two-month dip in four years, finishing 2008 down 3.1% and 3.4% down from the same period in 2007. ▲

Songbeat Sings A Sweet Song, But Is It Legal?



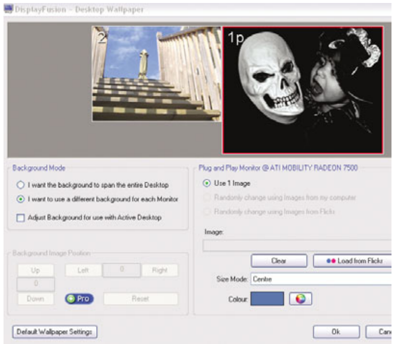
Bob dylan
A change is gonna come
Alice cooper
Blood on the tracks (bob dyla
Bob
Bob dylan & jack white
Bob dylan & joan baez
Bob dylan & joan biaz
Bob dylan & johnny cash
Bob dylan & paul simon & joa.
Bob dylan & the band
Bob dylan - rolling thunder re.
Bob dylan and george harrisc
Bob dylan and tom petty
Bob dylan by jem
Bob dylan vs. air
Bob dylan with the band
Bob dylan/sly & robbie
Bob dylan/the band
Bob enyart
Bob fass, bob dylan, guests
Boombox
Brian ibbott
Burnshee thornside (preview
Cat power
David bowie
Dylan bob
Dylan, bob
Elliott smith
George harrison

Boots Of Spanish Leather (ProjectPlaylist.com)
Boots Of Spanish Leather (SeeqPod.com)
Brownsville Girl (ProjectPlaylist.com)
Buckets Of Rain (ProjectPlaylist.com)
Butterfly Kisses (ProjectPlaylist.com)
Butterfly Kisses (SpoolFM.com)
Can't Help Falling In Love (ProjectPlaylist.com)
Can't Wait (SeeqPod.com)
Can't Wait (ProjectPlaylist.com)
Cocaine blues live bootleg (SeeqPod.com)
Days of '49 (SeeqPod.com)
Days of 49 (SeeqPod.com)
Deportees (SeeqPod.com)
Desolation Row (SeeqPod.com)
Desolation Row (ProjectPlaylist.com)
Dink's Song (Home Recording) (ProjectPlaylist.com)
Dink's Song [Home-Recording] (SeeqPod.com)
Dirt Road Blues (ProjectPlaylist.com)
Don't Think Twice(Live 1965) (ProjectPlaylist.com)
Don't Think Twice(Live 1965) (SeeqPod.com)
Don't Think Twice, It's All Right (SeeqPod.com)
Don't Think Twice, It's All Right (ProjectPlaylist.com)
Don't Think Twice, It's All Right (SpoolFM.com)
Don't Think Twice, It's Alright (ProjectPlaylist.com)
Don't Think Twice, It's Alright (SeeqPod.com)
Don't Think twice It's Alright (SeeqPod.com)
Don't Think twice It's Alright (ProjectPlaylist.com)
Don`t Think Twice, It`s Alrigh (SeeqPod.com)
Dont't think twice, it's all r (ProjectPlaylist.com)
Down Along The Cove (ProjectPlaylist.com)

The makers of Songbeat want you to know searching and listening to music online "is not forbidden," and downloading music "is not fundamentally illegal." Still, "it lies in the hands of the user to discern whether or not they have the right to download the particular music file at hand. [Songbeat] is totally legal." All that verbal drama would seem to stem from Songbeat's ability to search for music via Project Playlist, SeeqPod, Spool.fm, Last.fm, and others to let you listen, download, and record files and streams that the app finds. Further, you can burn said files to disc and import them in iTunes, WinAmp, and Windows Media Player. Songbeat says that because the desktop-based app doesn't access other users' hard drives or your own, it's not a P2P platform. If you're game, Songbeat lets you download 25 songs free before charging a one-time $29.99 upgrade for more. ▲

DisplayFusion Spreads Wallpaper To Individual Monitors

You've gone to the effort of clearing extra desktop space in order to erect a wall of multiple monitors that you can game on in style, right? Well, why not now deck that screen out with its own personality? Binary Fortress Software's recently updated DisplayFusion can help by slapping separate wallpaper on each screen vs. stretching the image across all the screens. Free and Pro ($20) versions both include Flickr integration; five wallpaper resizing options; and pre-configured hotkeys to move, tile, and span windows. The Pro version adds additional hotkey options, extended Flickr abilities, automatic updates, enhanced image positioning, and more. ▲


DisplayFusion - Desktop Wallpaper
2
1p
Background Image Position
Up
Left
Right
Down
Pro
Reset
Clear
Load from Flickr
Default Wallpaper Settings
Ok
Can

Background Mode
○ I want the background to span the entire Desktop
● I want to use a different background for each Monitor
☐ Adjust Background for use with Active Desktop

Plug and Play Monitor @ ATI MOBILITY RADEON 7500
● Use 1 Image
○ Randomly change using Images from my computer
○ Randomly change using Images from Flickr
Image:
Size Mode: Centre
Colour:

BIOS Upgrades Available Online

Compiled by Steve Smith

Before you send another motherboard to the landfill, consider upgrading the BIOS and giving your PC a new lease on life. Here are a few recently released upgrades. Readers can check out www.cpumag.com/cpumar09/bios to see our entire upgrade list.

Manufacturer	Model	Version	Date	Description	URL
Aopen	EZ945-GC	1.08	11/21/2008	Fixes RTC timer counter delay	download.aopen.com.tw/Download.aspx?RecNo=11788&Model=2626&Section=8&DL=yes
ASRock	K10N780SLIX3-WiFi	1.40	12/18/2008	Updates CPU code; supports Instant Boot	download.asrock.com/bios/AM2+/K10N780SLIX3-WiFi(1.40).zip
Biostar	Tpower X58 5.x	0.9.5.3	12/12/2008	Updates BIOS source code	www.biostar.com.tw/utility/biosdl.php?BID=1175
DFI	BI P45-T2RS	B245DA21	10/21/2008	Initial release	img.lanparty.tw/Upload/BIOS/CM/B245DA21.zip
Gigabyte	GA-EX58-DS4 (rev. 1.0)	F3	11/14/2008	Fixes CPU compatibility issues	america.giga-byte.com/FileList/BIOS/motherboard_bios_ga-ex58-ds4_f3.exe

Job Of The Month

If you are a Guitar Hero maniac, then grab your plastic ax and head to the oddest job interview you may ever have. Activision subsidiary Infinity Ward needs temp testers for Guitar Hero titles in Foster City, Calif. The job qualifications are unique, to say the least. In addition to knowledge of Excel, Word, and bug-testing software, you also should be able to pass specific GH competency prerequisites. Infinity Ward is looking for gamers who can play one of the following challenges at Expert level: the GH3 track "Raining Blood" on guitar; GH World Tour track "Hot for Teacher" on guitar; World Tour track "Damn It" on drums; or World Tour track "Heartbreaker" on microphone. For experienced game testers, however, the bar is a little lower. They will accept your playing through any one of these challenges at the Hard setting. We have to think there will be a lot of Red Bull and Monster drinks involved in the interview process. No word on whether Carpal Tunnel Syndrome insurance is provided.

http://jobs.gamasutra.com/jobseekerx/viewjobrss.asp?cjid=17538&accountno=101

Raw Numbers

32% **Percent of college students who use Gmail as their primary email account**

(eROI)

www.mediapost.com/publications/?fa=Articles.showArticle&art_aid=96664

1,742 **Average number of text messages sent or received by users between 13 and 17 years old**

(Nielsen)

www.nielsen.com/solutions/ShortCodeMarketing.pdf

65% **Percent of Americans who say they cannot live without Internet access**

(Intel/Harris)

www.intel.com/pressroom/archive/releases/20081215corp.htm?iid=pr1_releasepri_20081215r

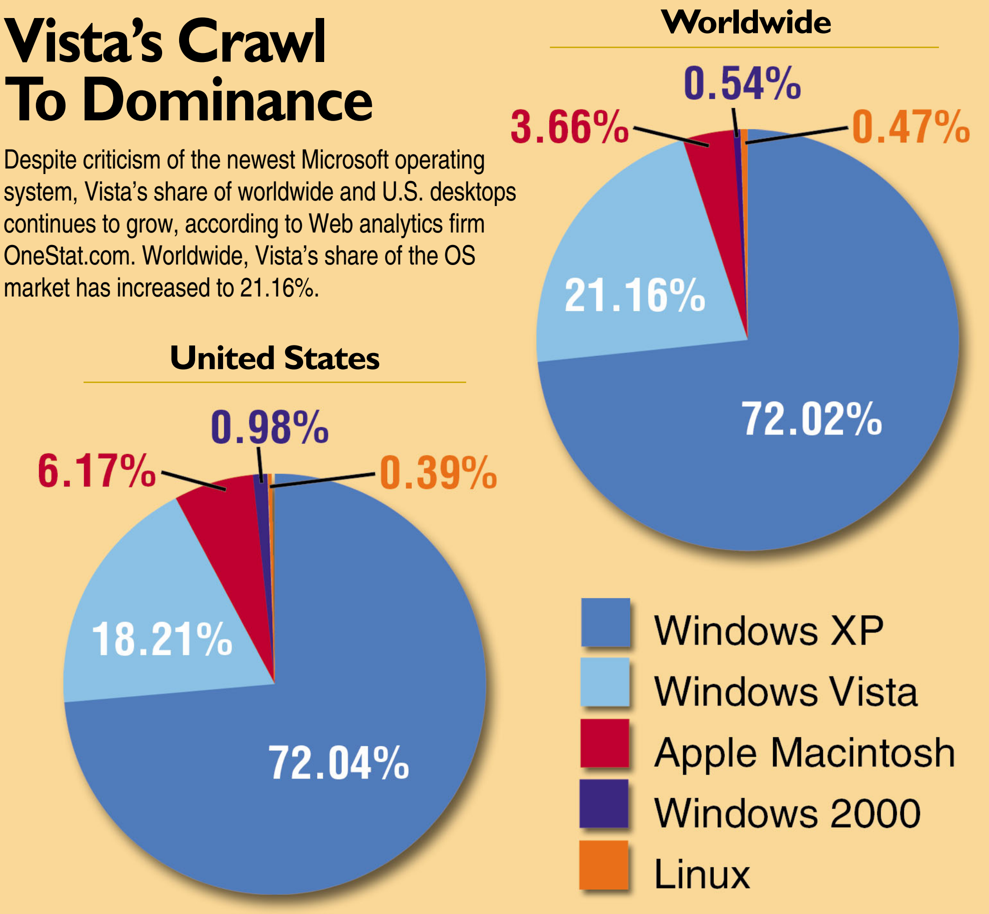
10% **Percent growth in 2008 Black Friday Web traffic over 2007**

(Nielsen)

www.nielsen-online.com/pr/pr_081201.pdf

Vista's Crawl To Dominance

Despite criticism of the newest Microsoft operating system, Vista's share of worldwide and U.S. desktops continues to grow, according to Web analytics firm OneStat.com. Worldwide, Vista's share of the OS market has increased to 21.16%.



Email Failing With Students

For the last decade, email has reigned as the true killer app of the Internet age, but the next generation of digirati may replace the classic Inbox with its phone deck. According to a recent eROI study, only 26% of college students cite email as their preferred mode of digital communication, lagging far behind the 37% who prefer text messages. Most students maintain an email address mostly for communicating with their families (81%). As a marketing channel, email gets barely a passing grade with the college crowd, with 61% saying they rarely or never respond to promotions in their Inbox.

www.mediapost.com/publications/?fa=Articles.showArticle&art_aid=96664

The Saint

by Alex St. John

Windows 7 Sucks Less

I took a lot of heat back in 2006 for being one of the early voices warning consumers that Vista was shaping up to be a real knee biter of an OS release for Microsoft. I got a barrage of emails accusing me of being a disgruntled spyware vendor who was just mad that Vista did such a fantastic job on security. It's not without some degree of satisfaction that two years later, there is a pretty broad consensus that Vista was a bust, which even Microsoft's CEO Steve Ballmer has backhandedly acknowledged by calling the OS a "work in progress."

In case anybody missed my earlier columns on the subject, they can be summarized as follows:

1 Vista's brilliant security architecture basically boils down to breaking everything so that even some of the spyware no longer works and warning you anything you use your PC for is a potential security risk, thereby making any security problems that result from your capricious insistence on using your computer—despite constant warnings—your fault, not Microsoft's.

2 Vista is loaded with lots of exciting new features that you might get around to appreciating as something other than bloat one day, providing you can find them in the convoluted new UI and stop wrestling with Vista to simply install an application or get a printer to work long enough.

3 Don't get me started on the absurd mess Microsoft made of gaming under Vista; too often, games don't work, and when they do, they run slower than they did under WinXP. Genius!

Alex St. John was one of the founding creators of Microsoft's DirectX technology. He is the subject of the book "Renegades Of The Empire" about the creation of DirectX and Chromeffects, an early effort by Microsoft to create a multimedia browser. Today Alex is President and CEO of WildTangent, a technology company devoted to delivering CD-ROM quality entertainment content over the Web.

Of course, Microsoft's biggest crime, in my opinion, is they knew how bad Vista was when they released it. They tried to bury the evidence and the criticism with marketing dollars and shipped it anyway, instead of actually making a quality product they were proud of. The real kicker is the Mojave ad campaign, in which they show consumers how stupid they are for not appreciating Vista the way Microsoft wants them to, while simultaneously demonstrating how gullible consumers are by showing them panting with enthusiasm for a new Microsoft OS even as they recognize that Vista sucked! I'd love to see the Mojave ad where they let consumers take home a new Vista PC and have them try to get their old apps and peripherals running on it.

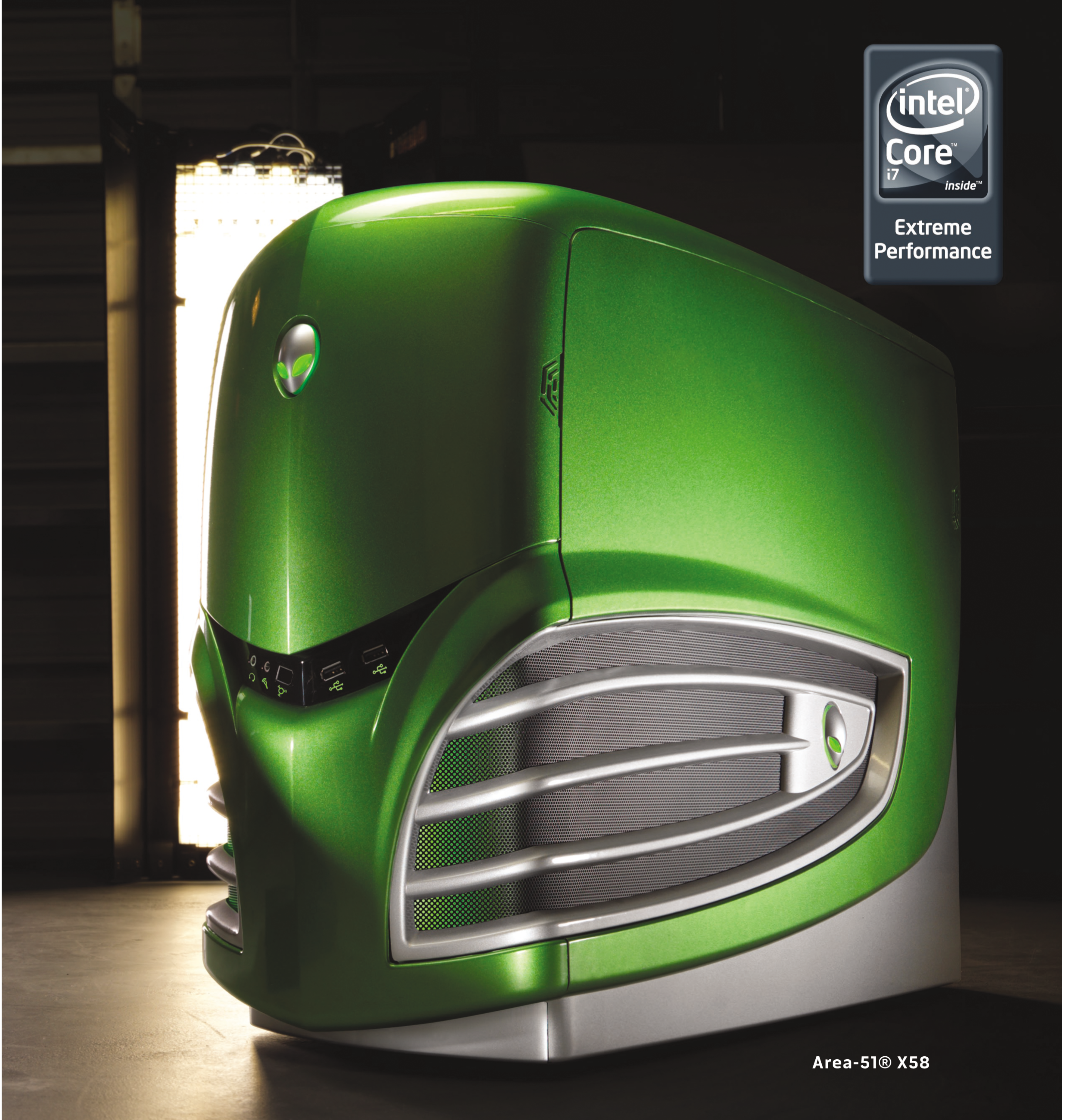
Now that Vista has sufficiently lowered everybody's expectations, we're ready to get excited about a new Microsoft OS, Vista 2.0! Er . . . scratch that, Windows 7! You probably won't be hearing from the "Vista" brand again once Microsoft sweeps it under the rug. So what exciting new features are in store for you in Windows 7? Well, the big promised feature is that it will suck less than Vista. Yes, Windows 7 will include less of what you hated about Vista, according to Microsoft.

Windows 7 will be less incompatible with existing applications, it will have fewer broken driver issues, it will be less bloated, and they're removing some of the crapware they built into Vista. Oh yes, and if you're one of the millions of consumers who find mice confusing to use and like fingerprints on your screen, it will support a touch-based UI. Windows 7 will also meet the needs of Google haters and those who bought Macs for the cool, bouncy toolbar UI, and not just because they're elegant and actually work.

Now, I know I may be coming across as a bit cynical, but I think it's fair for rational consumers to approach a new Microsoft OS with a healthy amount of skepticism. Microsoft has not earned the benefit of the doubt; in order to win back consumers' trust, the company needs to actually make a great product instead of telling us why we're idiots for not appreciating Vista.

That said, I remain hopeful for Windows 7. Microsoft's grudging acknowledgement that Vista "is a work in progress" and the apparent emphasis on compatibility and stability in Windows 7 seem to serve as some indication that Microsoft might have learned something from its Vista mistakes. The problem is that "This product sucks less than Vista" isn't a very compelling marketing message, so you can bet they'll invent some new "features" we don't need to get people excited, rather than simply focusing on making a reliable OS. ▲

Send your feedback to thesaint@cpumag.com



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DREAM HARDWARE

These Gizmos Don't Sing It, They Bring It

You don't need godlike vision to see through what you're hearing. But it can't hurt.

by Marty Sems

Hario Harion

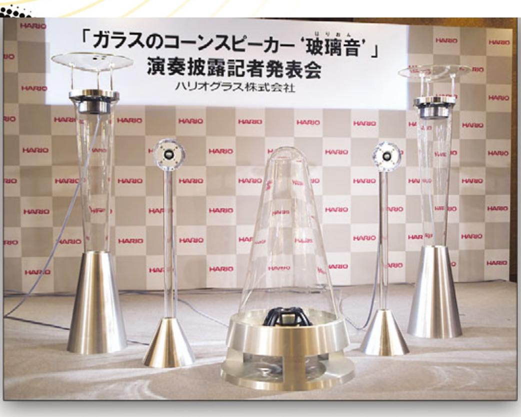
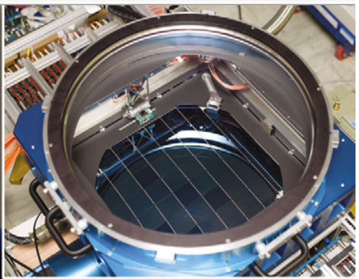
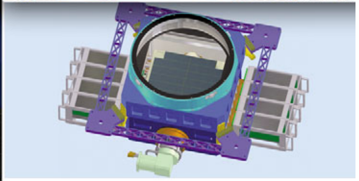


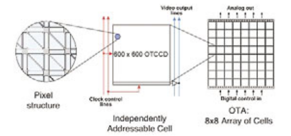
Photo: CrunchGear.com

The land of the rising sun can now enjoy audio as clear as day. Octogenarian glassware firm Hario (www.harioglass.com) convinced 23 subcontractors to spend nearly four years handcrafting this unique homage to Martian invasion movies. The Harion speaker set features a pair of acrylic tweeters, plus a center unit, two midrange drivers, and a woofer, all made of heat-resistant glass. Famed pianist and composer Tomoyuki Asakawa showed off the Harion's sound quality at its Tokyo unveiling, accompanied by virtuoso Ikuko Kawai on Hario's new glass violin. Clouding the picture is the Harion's $171,000 asking price, but a Hario exec intimated that a bit of demand could clear that right up.

Pan-STARRS GPC1

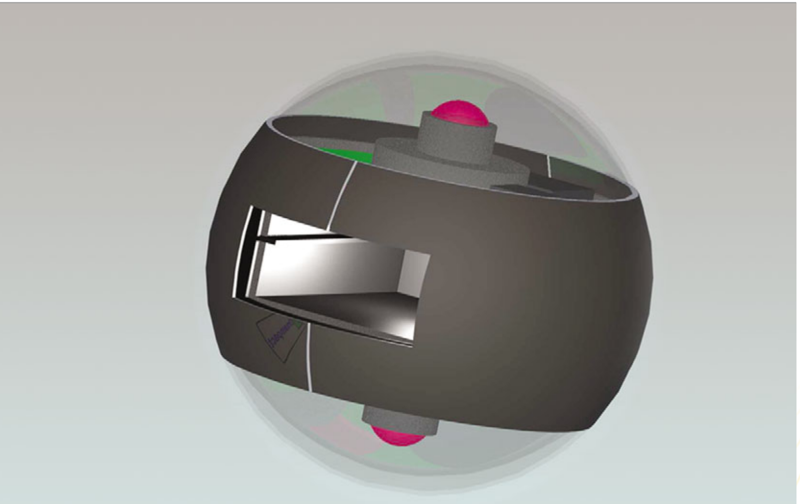






When you're charting an interstellar course for your Battlestar, Adama, you durned well better keep a sharp lookout for asteroids, comets, and such. That sort of needle:haystack ratio means you need cutting-edge digital imaging, such as this 1.4-gigapixel camera developed by the Institute for Astronomy at the University of Hawaii (pan-starrs.ifa.hawaii.edu). The 560mm GPC1 uses a big grid of Lincoln Laboratory Orthogonal Transfer CCDs (OTCCDs), which offers affordable defect reduction and high data readout speed, unlike a single, gargantuan imaging chip. Actually, the GPC1 is one of four massive cameras composing the Pan-STARRS (Panoramic Survey Telescope & Rapid Response System) PS4 telescope for the discovery and monitoring of NEOs (Near Earth Objects). NEOs are blamed for the extinction of the dinosaurs, Jerry Bruckheimer films, and other catastrophic events, so it makes sense to keep an eye (or four) on them.

Dreampact I-Ball



On the battlefield, there's no better reconnaissance asset than a pair of eyeballs. Edinburgh electronics design firm Dreampact (www.dreampact.com) wants to go one better. Here's its winning submission to a brainstorming competition hosted by the UK Ministry of Defence (www.mod.uk). The I-Ball is a high-res, wireless camera made specifically for combat. Troops can hurl it, grenade-like, around corners and into rooms for an immediate 360-degree look at the tactical situation without endangering themselves. More impressively, a bloke with a grenade launcher can volley the resilient camera into harm's way. Not only can the I-Ball continue to provide real-time video while in flight, but its custom image-stabilization technology makes the intelligence as intelligible as possible. ▲

Networked Storage Brawl

Pick A NAS With Some Sass

As the price of a hard drive storage falls, adding extra capacity to your desktop for music and movies becomes less painful. What really hurts, though, is when a hard drive failure takes your MP3 collection or library of high-def transcodes with it. Sure, you could protect against a crash by doubling up on disks and tapping into the RAID 1 functionality that's likely built into your motherboard already. But such a strategy will only take care of one PC at a time, and by the time you're done, you still end up with important files scattered all over the house.

The answer is centralization via networked storage. Pull the Word essays and Excel budget sheets from the workstation in your office. Grab the home movies and photo albums from the HTPC in the living room. Back up the music on your Zune. Get everything in one place, streaming all of those files across a Gigabit network (even 802.11g wireless works for watching a movie), and you've simultaneously taken care of organization and protection. The technology pays for itself, especially given the low price of high-speed routers and switches enabling snappy performance across the house.

We've rounded up five NAS devices ranging from diskless enclosures priced just north of $100 to tricked-out multi-drive setups tipping the scales at $1,000. All but one center on Gigabit Ethernet. Of course, if you're loath to spend hard-earned cash on what essentially amounts to a miniaturized PC, we'll also talk about the ups and downs of rolling your own storage box.

StorCenter ix2
$479
Iomega
www.iomega.com
● ● ◖

The StorCenter's chassis is incredibly small, which makes for a compelling reason to buy your next NAS instead of building one using leftover PC hardware.

How We Tested

Benchmarking networked storage is tricky business. There are innumerable workloads you could apply to a NAS drive to test its performance and yet not once convey a result that makes real-world sense. Intel saw this issue and developed its own software environment to generate meaningful scores and facilitate deep analysis. The NAS Performance Toolkit (www.intel.com/design/servers/storage/NAS_Perf_Toolkit.htm), as Intel calls it, measures the performance of HD video and recording over a network. It can emulate a scheduled backup, mimic the content creation behavior of a video-editing app, or simply tax the file transfer capabilities to and from a networked appliance. In order to evaluate the storage devices in this roundup, we ran the full battery of tests in Intel's Toolkit on a Core i7 965 Extreme platform with 6GB of DDR3-1333 on the 64-bit build of Windows Vista. All of the results you see are reported in MBps. Naturally, higher is better.

Iomega StorCenter ix2

We tend to exercise caution when looking at storage hardware with capacity already built in. After all, the prices on complete NAS systems don't tend to fluctuate, while hard drives have become incredibly cheap very quickly. At $479, (and figuring $220 in cost at today's prices for the drives themselves), you're paying just over $250 for Iomega's hardware and technology. That's not altogether bad considering the StorCenter ix2's user friendliness.

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ● ● ◖ 2.5 = ABSOLUTELY AVERAGE | ● ● ● ● ● 5 = ABSOLUTELY PERFECT

The StorCenter's chassis is incredibly small, which makes for a compelling reason to buy your next NAS instead of building one using leftover PC hardware. Basic power and activity lights on the front are easy to interpret, while power and reset buttons on the back are clearly labeled. Iomega includes two USB 2.0 ports and one Gigabit Ethernet port. When you attach a printer to one of those USB ports, an integrated print server shares it with other networked systems.

You won't find much documentation detailing the StorCenter's hardware platform, so we took our sample apart in order to investigate. Of course, the two 1TB hard drives take up most of the device's tiny chassis. A single PCB mounted atop the disks hosts Marvell's 88F5182 Feroceon storage and networking SoC (system-on-a-chip). Although the component runs as high as 500MHz, Iomega clocks the Feroceon at 400MHz and attaches 128MB of DDR to its integrated controller. The StorCenter uses 4MB of Spansion flash memory to hold its lightweight firmware, which is easy to access and configure. (Configuring the NAS itself is also a piece of cake.)

Despite the 88F5182 Feroceon's long list of system-oriented features, it isn't the most advanced storage platform. As a result, Iomega only makes two operating modes available: RAID 1 and JBOD. It follows, then, that the StorCenter ix2 is positioned as a backup device first and foremost. To that end, Iomega includes a copy of EMC's Retrospect Express software.

More advanced users will appreciate some of the content-sharing and interoperability features. For instance, UPS compatibility enables unattended system shutdown without risking data loss should the power go out. Indexing support delivers keyword searches inside Acrobat, Word, and Excel files. Moreover, an integrated UPnP media server works with DLNA (Digital Living Network Alliance)-certified media players streaming content to consoles, digital picture frames, and audio players.

The only real problem we see with streaming high-bitrate data is the StorCenter's transfer performance. In almost every one of our tests using Intel's NAS Performance Toolkit, throughput lagged behind competing NAS devices by a significant margin. Perhaps most worrying are the HD playback and recording numbers. Although you could undoubtedly store Blu-ray-quality video on the StorCenter ix2 and stream it to a playback device, accessing two streams would likely affect playback in a negative way. Four streams would almost certainly wreak havoc on frame rates, according to our bandwidth figures.

Netgear's X-RAID feature will automatically mirror data onto the second drive to protect against a mechanical failure.

ReadyNAS Duo
$399.99
NetGear
www.netgear.com
●●●◖

At the end of the day, we think Iomega's StorCenter is a sharp-looking component able to handle backup. It doesn't include a wide range of features, nor is its performance particularly noteworthy. However, its simple configuration routine and bundled EMC Retrospect Express software do endear it to mainstream buyers looking to simply centralize data without any frills.

Netgear ReadyNAS Duo

Netgear is best known for its networking hardware, but that didn't stop the company from acquiring Infrant Technologies back in 2007 and assimilating the latter's storage product family. The ReadyNAS lineup spans inexpensive home devices to enterprise-class rack-mounted chassis running Linux. If you want to play at the high end, a 1U, 4TB array costs right around $3,000. The ReadyNAS Duo is a *tad* more affordable, available for as little as $400. At that entry-level price point you get 500GB of capacity from a single drive—no RAID. Should you decide to spring for a second disk of the same capacity, Netgear's X-RAID feature will automatically mirror data onto the second drive to protect against a mechanical failure.

We have a bit of a conundrum, though. Let's say you add another hard drive for $80, enabling RAID 1 functionality with 500GB of total capacity and taking you to the same $480 price tag as Iomega's StorCenter. Because the Iomega's offering includes a pair of 1TB drives, it holds a clear capacity advantage. What makes the ReadyNAS Duo worth just as much with half of the space? We'll cut right to the numbers on this one: Performance is what sets Netgear's offering apart.

Although the ReadyNAS Duo only has one hard drive installed by default (compared to high-end units, such as Western Digital's ShareSpace, which has four disks in RAID 5), it's able to lay down faster scores than either the StorCenter ix2 or the ShareSpace. Only the two enclosures that shipped without disks are able to push more bandwidth. If speed is a factor

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in your NAS purchase, then the ReadyNAS' performance might make up for what it gives up in capacity. Of course, you could always just spring for the 1TB version, which sells for $679.99. But let's face it: 500GB isn't worth a $280 markup.

Beyond its smoking performance, Netgear's entry-level NAS is also more configurable than the Iomega unit, thanks to a storage-oriented hardware platform. If you open the left side panel, you'll see the logic board's backside with a 256MB DDR400 SO-DIMM attached. The other side of the PCB boasts an IT3107 network storage processor originally designed by the Infrant team. Using the IT3107, Netgear is able to tack on 64MB of NAND flash memory for the appliance's operating system, three USB 2.0 ports (supporting flash and hard drives, printers, and battery backup systems), and Gigabit Ethernet.

Three applications complement the hardware package: RAIDar, Netgear's discovery utility; NTI Shadow, a backup app that is compatible with Windows or Mac OS X; and the advanced Web-based setup routine. Enthusiasts with a basic understanding of networking technology will have no trouble discovering the ReadyNAS Duo, configuring its services, creating shares, and mapping drives without needing to consult a manual.

MobileSTOR MS2UTN+
$142
Sans Digital
www.sansdigital.com
●●●

> Simplicity is perhaps the MobileSTOR's most defining attribute.

The biggest reason to buy Netgear's NAS is its speed. We're a little uneasy about the single drive installed by default. With storage prices where they are now, it makes more sense to advocate network storage as a means to protect important data around the house. And with just one hard drive vulnerable to failure, you don't achieve that until you add a second drive. The ReadyNAS Duo's price seems a bit high, but the 500GB model is available online for roughly $50 less than its MSRP.

Sans Digital MobileSTOR MS2UTN+

As the only non-NAS enclosure in this roundup, Sans Digital's MobileSTOR MS2UTN+ can still be used as a central repository for surrounding workstations if you configure it as a direct-attached (connected to a particular workstation) device shared over the network. Granted, this configuration introduces its own interesting complications, such as additional loading on the workstation's host processor and saturation of that machine's network connection as client systems access it. But at a

Network Attached Specs

	Iomega StorCenter ix2	Netgear ReadyNAS Duo	Sans Digital MobileSTOR MS2UTN+	Synology DS209+	Western Digital ShareSpace
HDD trays	Two	Two (One empty)	Two	Two	Four
RAID modes supported	RAID 1, JBOD	RAID 1, JBOD	Spanning, RAID 1, RAID 0, SAFE33, SAFE50, JBOD	RAID 0, RAID 1, JBOD	RAID 0, RAID 1, RAID 5
Host interface	GbE, USB 2.0	GbE, USB 2.0	USB 2.0, eSATA	GbE, USB 2.0, eSATA	GbE, USB 2.0
Max capacity	2TB	500TB	2TB	3TB	4TB
Warranty	One year	Three years	One year	Two years	Three years
Weight	4.85lbs.	4.56lbs. (empty)	3.8lbs. (empty)	2.16lbs. (empty)	10.78lbs.
Additional features	EMC Retrospect Express Backup w/ unlimited licenses	Hot-swappable trays, NTI Shadow backup software	Auto-rebuilding, 80W PSU, RAID alarm, 1.6-inch fan.	AJAX-based management console, Synology backup software	Push-button USB transfer, network backup software (3 licenses)
Price	$479	$399	$142	$489	$999
CPUs	●●◖	●●●◖	●●●	●●●●◖	●●●◖

CPU RANKING ○ **0 = ABSOLUTELY WORTHLESS** | ●●◖ **2.5 = ABSOLUTELY AVERAGE** | ●●●●● **5 = ABSOLUTELY PERFECT**

price under $150 for the empty enclosure, DAS sounds mighty appealing.

Simplicity is perhaps the MobileSTOR's most defining attribute. The cube-shaped enclosure is incredibly compact, yet it sports two hot-swappable 3.5-inch hard drive trays released by sticking a paper clip inside the bay (similar to the latch on a powered-down optical drive). Despite its size, the MS2UTN+ still weighs almost 4 pounds as a result of its beefy metal frame. Three LEDs and a mute button adorn the enclosure's front, reflecting power, thermal status, and the health of your RAID array. If there is an alarm, you can acknowledge and silence it with the mute button.

Flip the box around and you'll see its two available interfaces: eSATA and USB 2.0. Without question, the 3Gbps eSATA connection is your best bet for aggressive performance. USB 2.0 maxes out at 480Mbps, capable of bottlenecking fast drives in a striped array. The back of the unit also has a knob responsible for setting the device's operating mode. Its seven positions really only correspond to five actual modes: Big (spanning), JBOD, FAST (RAID 0), SAFE (RAID 1), SAFE33, and SAFE50. SAFE33 creates two drive volumes, where the first third is mirrored and the remaining capacity is spanned, and SAFE50 creates a 50/50 split.

We didn't bother dismantling the MobileSTOR, which is fairly effectively sealed up, but Sans Digital tells us the MS2UTN+ is powered by a Silicon Image 5744 chipset. The SteelVine storage processor, as Silicon Image calls it, handles the onboard RAID processing. There's also an internal 80W power supply, which is more than ample for driving a pair of SATA hard drives and the box's own internals.

To test the MobileSTOR's performance, we connected it to the eSATA port on Asus' Rampage II Extreme motherboard. Although the enclosure also works with Linux and Mac OS X, we stuck to benchmarking under 64-bit Vista using Intel's NAS Performance Toolkit. Take a look at the benchmark chart and notice that the MS2UTN+'s transfer rates are substantially higher than any of the other units. This is because the scores reflect transfer rates over a direct, 3Gbps eSATA connection. Sharing the drives over a network for remote clients to access will add a layer of overhead and take a toll on throughput. So, with Sans Digital's MobileSTOR hooked up to a workstation directly, expect performance that paces the speed of an internal disk. However, as networked storage shared through a workstation, we think you'd be better served by a dedicated NAS drive not reliant on a host workstation for suitable performance and uptime.

At its stock price of $142, the MS2UTN+ ships sans hard drives. Our review unit included a pair of 750GB Seagate Barracudas. For the sake of comparing this enclosure's value to its networked competition, we'll consider adding a pair of 1TB Barracuda 7200.11s to its bottom line at $109 each. So, for just over $350, you get up to 2TB of capacity (or 1TB if you prefer data protection via RAID 1) in a DAS box that performs admirably as a local storage space connected via eSATA.

Disk Station DS209+
$489
Synology
www.synology.com
●●●●◖

Synology supports RAID 0 and RAID 1 modes, taking full advantage of the hardware available.

Synology Disk Station DS209+

You don't want to go through the trouble of rolling your own NAS out of leftover PC parts, but the idea of paying inflated prices for a box with disks already installed offends your delicate power user sensibilities. Meet Synology's Disk Station DS209+. As a NAS enclosure with two vacant drive bays, you might be wondering how Synology can get away with charging $489—more than Iomega's 2TB StorCenter. In short, the DS209+ is a significantly more powerful appliance.

Under its hood are an 800MHz processor and 512MB of DDR2 memory. We're not sure who makes the CPU (its heatsink didn't want to come off), but a connected 4-port PCI-E Marvell SATA controller suggests that the SoC is more advanced than any other processor we've discussed. The rest of the enclosure's features are fairly standard fare: two internal SATA connectors, one external eSATA connector, three USB 2.0 ports, and Gigabit Ethernet.

There's only so much you can do with two hard drives; Synology supports RAID 0 and RAID 1 modes, taking full advantage of the hardware available. Best of all, you're the one who decides whether to install 750GB disks, or if there's a special sale on 1TB drives, to go that route instead.

Our concern with a DIY box like the DS209+ is its fit and finish, because the manufacturer has to take user-serviceability and a longer compatibility list into consideration throughout the design process. To some degree, Synology's DS209+ falls victim to those concessions. The enclosure is incredibly easy to disassemble, but built of cheap-feeling plastic instead of metal, which Netgear and Iomega use in their boxes. It's also quite a bit larger (no doubt to make working under the hood easier). Those compromises aren't deal breakers, though. The switches and USB/eSATA interfaces feel solid. Moreover, the exterior shell is an attractive shade of matte black. The *pièce de résistance* is a 60mm cooling fan that spins at variable speeds according to thermal load; even at its middle setting, the fan is nearly quiet. The smaller Netgear and Iomega products are both louder.

The 800MHz processor and large memory pool translate into exceptional performance for Synology. We armed the DS209+ with a single 1TB Samsung Spinpoint F1 drive, and it managed to win eight of 12 tests (not counting the Sans Digital MobileSTOR, which was directly attached via eSATA). A pair of drives set to run RAID 0 would be even faster, but again, RAID 1 is the way to go in a two-drive enclosure responsible for protecting important files.

Getting the DS209+ configured is a piece of cake, and the accompanying software is extremely well-polished. Where most competing devices employ very-obviously Web-based admin panels, the DS209+'s Disk Station Manager 2.0 is driven by an AJAX-based interface, so the look and feel are more application-like than a typical browser-based config. Synology also includes its Data Replicator 3 backup software, though the DS209+ also supports EMC Retrospect, Symantec Backup Exec, and Acronis True Image (none of which are included).

The Synology DS209+ is, without doubt, expensive for a diskless NAS enclosure. You could easily build a Core 2 Duo-based machine for a similar price once the cost of supplying storage is factored in. But the compact chassis, quiet operation, comprehensive management tool, and exceptional performance come together to make Synology's offering our favorite for folks more interested in using NAS than building it.

Western Digital ShareSpace

Armed with four drive bays and more extensive RAID support than the other NAS devices, Western Digital's ShareSpace 4TB is the juggernaut of this roundup. It isn't small and it's not light. But thanks to WD's subtle styling, it looks really sharp.

The ShareSpace is essentially an SFF PC. It sports Marvell's 88F5281 SoC, a more advanced version of the Feroceon processor found in Iomega's StorCenter. The dual-issue chip runs at 500MHz, includes PCI-E connectivity (to which WD attaches a 4-port Marvell SATA controller), PCI-X, Gigabit Ethernet, USB 2.0 support, and an integrated memory controller. Western Digital doesn't go into much depth on the ShareSpace's hardware, but we were able to find a pair of 512Mb DDR2 memory modules on the ShareSpace's logic board, totaling 128MB. Plug a flash drive into the front USB 2.0 port and press the transfer button. The ShareSpace sucks up the data on the flash drive. Plug a pair of external USB hard drives into the back to expand the ShareSpace's capacity beyond its 4TB internal limit.

Western Digital draws on its expertise as a storage vendor to make the ShareSpace as efficient as possible. Its four 1TB hard drives belong to the GreenPower family, which spin at 5,400rpm. There's a stigma associated with 5,400rpm drives that they're poor performers. However, the GreenPower drives do surprisingly well in the benchmarks because they help keep power consumption in check. By default, the ShareSpace's drives are organized in a RAID 5 array, which offers the best balance between capacity and data protection. (RAID 0 and 1 are both supported, too.) In RAID 5, parity information is written across the four drives so that if one disk fails, you don't lose any information.

The Homebrew Factor

No discussion of NAS is complete, especially in the midst of power users, without acknowledging the viability of DIY networked storage. There's a good chance you've built a handful of PCs, at least. If you have one lying around that's been replaced by more modern hardware, it'd likely make a competent storage platform, even in its old age.

Granted, that doesn't mean you could repurpose a dusty Pentium III platform right away. It needs the right network interface, a capable storage controller, ample memory, an enclosure able to hold a few hard drives, and a complementary operating system. Depending on just how geriatric your mothballed machine really is, adding or replacing the components to get it up to speed could outstrip the cost of an off-the-shelf NAS.

Of course, your performance requirements will scale up and down depending on the operating system you choose to use. On one end of the spectrum are very lightweight approaches, such as FreeNAS (www.freenas.org), a BSD distribution supporting software-based RAID, dynamic DNS, a number of different file systems, and iSCSI. On the other, it's tremendously easy to recycle an old copy of Windows XP. In either case, a Pentium III, Celeron, VIA Nano, or inexpensive Athlon X2 processor would work fine. Arm the system with between 512MB and 1GB of memory, drop an inexpensive SATA RAID controller card into a PCI or PCI-Express slot, and start adding hard drives. ▲

ShareSpace
$999
Western Digital
www.wdc.com
● ● ● ◖

Armed with four drive bays and more extensive RAID support than the other NAS devices, Western Digital's ShareSpace 4TB is the juggernaut of this roundup.

The tradeoff is a loss of space. Formatted in RAID 5, the 4TB ShareSpace offers just under 3TB.

Performance is good, too. The RAID-protected ShareSpace trails the 500GB Netgear enclosure in most benchmarks but manages to push ahead in the directory copy tests. It beats Iomega's StorCenter across the board, putting it in the middle of our pack.

Perhaps the largest obstacle to overcome is the ShareSpace's $1,000 price tag. A 1TB WD drive sells for about $100 online, meaning you pay around $600 for the NAS enclosure itself. That's a tough pill to swallow when the Synology DS209+ sells for less than $500 and gives you the same RAID 1 protection. Western Digital does add value by bundling backup software and licenses, letting three workstations automatically save important information to the NAS. Unfortunately, the backup app didn't care for our 64-bit installation of Vista and crashed each time we started it. Although the rest of Western Digital's setup routine is intuitive enough to be self-guiding, the only reason we can see justifying the extra cost would be if you needed the the ShareSpace's capacity. ▲

by Paul Cross

Speeding Over Ethernet

To test each of our units, we used Intel's NAS Performance Toolkit, which taxed these storage appliances in a number of areas. We should note again that because the MobileSTOR MS2UTN+ is a direct-attached unit, performance numbers will be significantly higher than the other drives, which we tested over a LAN connection. Expect lower results if you use the Sans Digital unit as a shared drive connected to a networked PC.

Intel NAS Performance Toolkit*	StorCenter ix2 2TB	ReadyNAS Duo 500MB	MobileSTOR MS2UTN+	DS209+	ShareSpace 4TB
HD Video Playback	10.1	23.6	52.8	30.7	23.1
2x HD Playback	11	36.1	28.7	29.4	26.3
4x HD Playback	11.7	38.7	27.4	36.6	23.8
HD Video Record	11.4	18.7	84.2	39.1	11.6
HD Playback and Record	11.3	22.6	44.5	26.7	15.7
Content Creation	8	9.2	5.5	13.2	8.8
Office Productivity	19.5	20.9	39.4	5	18
File Copy to NAS	8.1	12.4	89.3	32.9	9
File Copy from NAS	14.2	29.3	53	31.6	24.4
Dir Copy to NAS	3.7	4	44.3	17.5	4.5
Dir Copy from NAS	8.4	8.6	28.8	19.1	11.5
Photo Album	14	10.1	28.5	7.5	14.3
* Results in MBps					

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ● ● ◖ 2.5 = ABSOLUTELY AVERAGE | ● ● ● ● ● 5 = ABSOLUTELY PERFECT

Towers Of Power

Find The Perfect Home For Your Hardware

To some, a chassis is nothing more than a shell that holds a PC's guts. To others, it's the flashy exterior making a statement about the components inside. But whether you're an enthusiast concerned only with function or a power user who doesn't mind a little form to speak volumes about his hardware, the right case looks good, is easy to work inside, and has room to fit plenty of upgrades. The four full-tower enclosures in our roundup fit all three criteria. But what makes one chassis worth $600, while another costs $150?

How We Tested

Benchmarking cases involves measuring thermal and acoustic performance. To that end, we installed an Asus Rampage II Extreme motherboard and Core i7 965 Extreme into each chassis, along with two noisy Radeon HD 4870 graphics cards and 6GB of DDR3 memory. We placed an Extech thermal probe inside each case, as close to the same spot as possible halfway up the motherboard, measuring ambient temperatures after 30 minutes at idle and the same period of time running Prime95/3DMark Vantage. Then we used an Extech sound pressure meter from 1 meter away in a completely silent room to measure the noise generated by each enclosure head on.

ABS Canyon 695

Talk about a decadent piece of hardware. ABS' $600 Canyon 695 is constructed entirely of aluminum; so even though it's most definitely the largest case in this roundup, it also turns out to be one of the lightest. The chassis has a little secret, too. Most power users know ABS as a system builder without the manufacturing capacity to craft its own cases. Truth be told, the Canyon is actually a Lian Li Tyr PC-X2000, distributed exclusively in the United States through ABS. Not that we have any problem with a Lian Li case sporting ABS branding: The Taiwanese case vendor is known through enthusiast circles as one of the leading case makers, so ABS gets credibility by association.

The Canyon is visually striking—unlike any other chassis we've seen. It's immensely tall, for starters. But whereas most enclosures sport a handful of drive bays up front and, at the most, a door covering them up, the Canyon's design involves a trio of 140mm fans pulling cool air into the case, leaving no room for front-mounted optical drives. Instead, a black brushed-aluminum panel snaps over those fans. Head on, you see nothing but smooth lines. Of course, the external drives have to go somewhere. And you'll find them on the side of the case, which is a configuration for which we don't particularly care. After all, the enclosure is already more than 2 feet tall, 17 inches deep, and 9 inches wide. Factoring in extra space for a side-ejecting tray complicates the question of where to put it. From any other angle, the Canyon is an artisan's piece. The top of the case sports simple power and reset buttons, plus a hinged lid covering eSATA, FireWire, USB, and audio I/O. The back boasts three cooling fans (two 80mm and one 140mm), cutouts for watercooling

> If you don't mind an extra bit of fan noise, the preinstalled coolers can be spun faster using an integrated fan controller on the chassis' front, under the aluminum panel.

Canyon 695
$599.99
ABS
www.abs.com
●●●●

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

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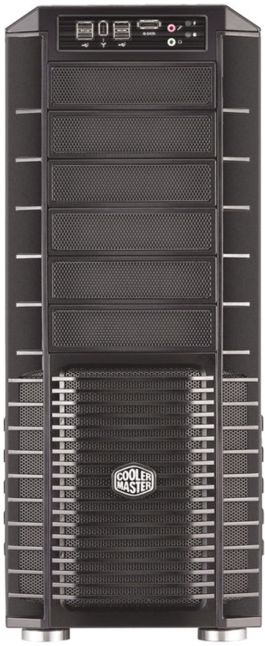
hoses, and room for eight expansion slots (as opposed to the seven found on some of the competing boxes).

Inside the case is more evidence of ABS' attention to detail. Three chambers help isolate heat from the power supply, motherboard, and hard drives, respectively. Sound-dampening material on each side panel helps soften the noise installed components make. And instead of simply setting aside space for drives, ABS includes a couple of backplanes, which take 3.5-inch SATA hard drives. Unfortunately, that also means 2.5-inch SSDs and Western Digital VelociRaptors don't slide into place on the backplanes, so you'll need to pick your storage carefully. We also ran into trouble installing certain power supplies, which were too long and couldn't clear the sideways-mounted external drive bays situated at the top of the Canyon. PC Power and Cooling's massive Turbo-Cool 1KW didn't quite make it, but Cooler Master's UCP 1100W did.

Notice that there's plenty of space left above where you'd install a power supply and four holes for hoses under the rear exhaust fan. The Canyon 965 is, by default, set up for air cooling, but ABS also lays a foundation for a watercooling setup, and for good reason. Because the case is sealed up, sound-insulated, and split into chambers, it runs warm. The difference between the Canyon and a more free-flowing chassis like Cooler Master's HAF 932 isn't huge (4 degrees Celsius at idle and 6 C under load), but for enthusiasts intent on shedding as much heat as possible for more reliable overclocks, the difference is notable. With liquid cooling, however, you can more effectively dissipate heat from the processor, graphics card, and northbridge, exhausting it from a radiator mounted at the top of the case.

Conversely, even if you do stick to air cooling, ABS' Canyon 695 is the quietest case in our roundup, idling around 43 decibels and generating about 45 under load. If you don't mind an extra bit of fan noise, the preinstalled coolers can be spun faster using an integrated fan controller on the chassis' front, under the aluminum panel.

Overall, it'd be hard not to like the Canyon. Compartmentalized cooling, brushed black aluminum throughout, concessions for watercooling, and sound insulation—the case is a true piece of enthusiast hardware. But then there's the price tag of $600. If you can afford Core i7 965 Extremes, Radeon HD 4870 X2s, and solid-state storage in RAID 0, then there's a good chance ABS' asking price won't cause sticker shock. In that case, the Canyon is unrivaled in build quality and acoustic performance. If you're looking for the pinnacle in power user chassis technology, this is it.



HAF 932
$159.99
Cooler Master
www.coolermaster.com
● ● ● ● ◖

A peek inside the HAF 932 suggests why Cooler Master didn't put more emphasis on clear windows.

Heat & Noise (Or Lack Thereof)

Aside from being able to comfortably house your choice components, a good chassis should be able to keep those choice components cool and quiet. We took thermal and acoustic readings for our quartet of cases, both idling and under load.

	ABS Canyon 695	Cooler Master HAF 932	Lian-Li PC-P80R	Thermaltake Spedo Advance Package
Thermal (Ambient)*				
Idle	28	24	27	26
Load	30	24	28	27
Acoustic (from 1m)**				
Idle	43	46	45	45
Load	45	52	46	47

*Degrees Celsius
**dB

Cooler Master HAF 932

The Cooler Master HAF 932 is a major departure from the ultra-refined Canyon 695. Start with the meaning behind HAF: High Air Flow. Whereas the Canyon cleverly isolates heat using a trio of chambers, the HAF 932 simply blasts hot air out of its case. True to its name, the HAF 932 includes a burly cooling system consisting of 230mm fans up front, on the left side panel, and on the top panel. A 140mm fan brings up the rear.

Although the HAF's exterior isn't as classic-looking as the Canyon's, the box is still attractive. Much of what you see from the outside is simply black mesh, which promotes plenty of airflow. The other exterior surfaces are painted black to match, except for the primered gray backside. Up front, you'll find six 5.25-inch drive bays and one 3.5-inch bay (if you use an included adapter to convert one of the 5.25-inch bays). Front-panel

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Essential Case Specs

	ABS Canyon 965	Cooler Master HAF 932	Lian Li PC-P80R Armorsuit	Thermaltake Spedo Advance Package
Material	Aluminum	Steel	Aluminum	Steel
Motherboard compatibility	eATX, CEB, ATX, mATX	eATX, ATX, mATX	eATX, ATX, mATX	ATX, mATX
Dimensions (inches, HxWxD)	26.8 x 9.1 x 17	21.5 x 9 x 22.7	24.9 x 8.6 x 24	21.1 x 9.1 x 24
Internal drive bays	6	6 (w/ converted 5.25" bay)	6	6
Rear expansion slots	8	7	10	8
Front panel connectivity	USB 2.0, FireWire, eSATA, audio	USB 2.0, FireWire, eSATA, audio	USB 2.0, FireWire, eSATA, audio	USB 2.0, eSATA, audio
Weight (pounds)	26	29.1	31.3	28.7
Additional Features	2x 80mm exhaust fans, 3x 140mm intake fans, 1x 140mm exhaust fan	3x 230mm fans, 1x 140mm fan	4x 140mm fans, 1x 120mm fan, ATI CrossFire side-panel art	2x 230mm fan, 1x 140mm fan, 3x 120mm fan, thermal chamber system
Price	$599.99	$160	$630	$209
CPUs	●●●●	●●●●◖	●●●◖	●●●◖

connectivity includes USB 2.0, FireWire, eSATA, and audio I/O.

A small rubber tray at the front of the top panel is a great place for keeping your keys or wallet. Underneath, though, is a fill hole for a watercooling system. That's right, Cooler Master's HAF 932 is yet another chassis shipping with copious air cooling but designed for liquid setups, as well. The left side panel employs a mixture of cooling (via a massive 230mm intake fan), ventilation (cut into the panel itself), and exhibitionism (a window in the upper-left corner with a view inside). Around back is a smaller 140mm exhaust fan and room for seven expansion slots. We like that Cooler Master offers two places to put your power supply. PSUs with shorter cables or cooling fans in odd places should have no trouble in the HAF.

A peek inside the HAF 932 suggests why Cooler Master didn't put more emphasis on clear windows. Mainly, the case's interior is flat gray and not particularly attractive. Nevertheless, there are some cool innovations inside, such as tool-less hard drive trays, tool-less 5.25-inch drive trays, and screwless expansion slot retention clips. You could almost build a gaming box based on the HAF without a screwdriver if it weren't for the brass standoffs used to secure your motherboard.

Given a sub-$200 price point, it's hardly a surprise that Cooler Master's HAF 932 is crafted of steel rather than aluminum. Thus, although it's notably smaller than the Canyon 695, the HAF winds up being a few pounds heavier than its aluminum competition. Thankfully, Cooler Master at least has the foresight to round the edges throughout its case, protecting the fingers and knuckles working inside. We would've liked to see the interior painted to match the attractive black exterior though, an extra step a number of other vendors take with their higher-end towers.

The HAF's design isn't particularly elegant, and its build quality doesn't come anywhere close to what ABS achieves in the Canyon 695. But the case's thermal performance is, not surprisingly, superior. Three 230mm fans and one 140mm fan keep the ambient temperature 4 degrees Celsius lower than the Canyon at idle and 6 C lower under load. The price you pay is additional noise. Running at full tilt, Cooler Master's chassis generated an additional 7 decibels. Your mileage may naturally vary; without question, the two Radeon HD 4870s in CrossFire were the loudest components in the uninsulated enclosure, so a less-aggressive graphics configuration wouldn't be as loud.

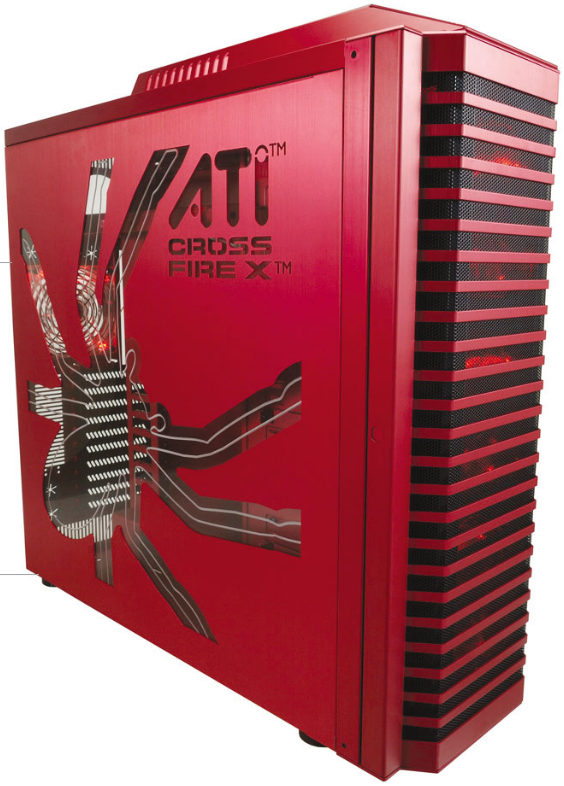
The HAF 932 isn't a luxurious case, but it does an exceptional job covering the bases. Steel construction is durable, despite its extra heft. Cooler Master also made a concerted effort to employ toolless installation processes wherever possible. The case's aesthetics leave something to be desired, but we think you'll have a hard time finding a full-tower box with the HAF 932's functionality or performance at that $160 sticker.

Lian Li PC-P80R Armorsuit

We were impressed with ABS' Canyon 695 and its aluminum frame. But that $600 price tag is really tough to swallow. Lian Li's PC-P80R Armorsuit appeals to an even narrower audience for two reasons. First, it costs even more than the tall ABS enclosure—roughly $630 online. Second, it's painted red and adorned with a side-panel with ATI CrossFireX cut out of the aluminum. If you're rocking a pair of Radeon HD 4870s, then the PC-P80R is probably looking pretty sexy right now (but not so much if it's Nvidia SLI multi-GPU technology under your hood).

Assuming your enthusiast blood indeed runs red, the PC-P80R is a visual

CPU RANKING ○ **0 = ABSOLUTELY WORTHLESS** | ●●◖ **2.5 = ABSOLUTELY AVERAGE** | ●●●●● **5 = ABSOLUTELY PERFECT**



Assuming your enthusiast blood indeed runs red, the PC-P80R is a visual feast.

PC-P80R Armorsuit
$630
Lian Li
www.lian-li.com.tw
● ● ● ◖

feast. The entire enclosure is made up of hair-line brushed anodized aluminum, inside and out. It isn't an obnoxious red, either, more of a subtle deep crimson. The front is covered by a heavy aluminum door that locks with a real key, not one of those circular notched keys. Inside the door are a number of red aluminum drive bay covers, peppered with ventilation holes. Three 140mm fans attached to the door itself blow through, facilitating plenty of airflow. There's nothing special about the right side panel, but as mentioned, the left side has "ATI CrossFireX" cut out, along with a large silhouette of a spider. The chassis' back boasts support for no fewer than 10 expansion slots, four liquid-cooling hose inlets, and a top-mounted power supply.

Everything inside the PC-P80R is clean and classic. But although there aren't any frills, small details make all of the difference. Hard drives are all installed with grommets, which isolate the drives from the chassis itself, minimizing noise, for example. Also, the surface where the side panels meet is buffered by flexible bearings that gently push out to prevent any rattling. Nearly every aluminum edge is rolled, and fan cables are neatly tucked away. The front door secures with the firm click of a ball bearing rolling into place. Plus, Lian Li's own fan controller is neatly integrated on the front of the chassis, nestled right up toward the top. As a result, enthusiasts get complete control over fan speeds, which play a major role in determining thermal and acoustic performance, too.

The PC-P80R doesn't include the noise-dampening efforts that Lian Li built into its ABS-branded Canyon, so we're hardly surprised that the red rocket made more noise than the Canyon with our Radeon HD 4870s running in CrossFire. Of course, it's also worth noting that we tested the PC-P80R with its fan controller set as low as possible, which drops the three front-panel fans and top cooler down to 800rpm, according to Lian Li. Remember, though, that noisy components are generally at fault for loud acoustics, and a pair of 4870s challenge the design of any chassis. If you want better thermal performance and can tolerate a little extra sound, the fans spin at up to 1,180rpm.

If you're an affluent owner of AMD's new Phenom II or a couple of Radeons, Lian Li's PC-P80R makes it easy for you to show off. It sports the very clearly customized side panel that you might try etching yourself, except it's done with typical Lian Li precision. Some might complain about the lack of tool-less drive bays, but it's a pleasure to work in a case like this. A little old-school system-building doesn't bother anyone over here. It's just regrettable that the number of folks willing to pay more than $600 for an AMD-themed chassis (especially given the AMD's emphasis on value lately) is going to be small.

Enthusiasts who like the idea of the PC-P80R, but not its lofty price or décor, should check out Lian Li's PC-P80 Armorsuit instead. Let's face it, AMD's Spider platform is so last-generation, anyway. The all-black design incorporates every feature we liked about the PC-P80R model, only it's neutral-colored and about $260 less expensive. That makes it a better value than the Canyon 695 and worth spending an extra $200 over the cheaper steel boxes.

Thermaltake Spedo Advance Package

Thermaltake's Spedo takes the enthusiast lines of Cooler Master's HAF 932 design and makes them more aggressive. The chassis itself centers on a steel frame, but achieving the bumps and ridges requires a fair bit more plastic, resulting in an empty weight of just over 27 pounds.

If you enjoy the classic looks of the Canyon 695, the curiously named Spedo will likely come off garish. The exterior is principally painted black, with a gray bezel that lines the front and top of the case. Black mesh covers the case's entire front and much of its top panel. Each side panel has ventilation holes cut strategically in places where fans can be installed, and the left panel also sports a plastic window. Around back, you'll find a pair of 120mm exhaust fans, a bottom-mounted PSU bracket, cutouts for watercooling hoses, and screwless expansion slot retention brackets. Front-panel connectivity includes a pair of USB 2.0 ports, eSATA, and audio I/O. The power and reset buttons are separate . . . and very cheap-feeling. Sharp angles give the exterior a mechanical look that we think works better in a game room than an office. Style is subjective though, so your opinion might be different.

Inside the chassis is where features start mattering a lot more. Thankfully, Thermaltake treats the interior of the Spedo significantly better than the exterior. Hard drives are easily installed using screwless trays; eight expansion slots provide plenty of room for 3-Way SLI configurations; and a bottom-mounted power supply bay provides lots of space up top for the 230mm exhaust fan pulling air out of the chassis. Everything inside the case is painted black to match the outside, which is a notable advantage over Cooler Master's less-polished HAF 932.

There are actually two versions of the Spedo. The base model, priced around $170, lacks a side-panel window and a lot of the cooling features found in the Advance Package. It's also missing the aesthetic flair inside, as Thermaltake leaves it gray (not that you'd notice without a window). You'll pay an extra $40 or so for the Advance Package, adding the window, interior color, exceptional cable management through a trio of plastic covers behind the motherboard, significantly more cooling (six fans come bundled), and Thermaltake's thermal chamber system. Dubbed A.T.C. 3 (Advanced Thermal Chamber), the feature was designed to isolate heat from various components using plastic partitions—similar to the idea behind ABS' Canyon, only more modular.

Our favorite innovation, though, is what Thermaltake calls its plug-and-play fan. In most enclosures with side-panel fans, you prop the side open, connect the power cable, and try to tuck it out of the way. The Spedo has a small contact built into the steel frame that powers the side panel's fan. Pop it off, and the fan stops spinning without any builder intervention.

Given its number of fans and thermal optimization through the A.T.C. 3 chamber system, we expected the Spedo to serve up exceptional performance. In testing, it kept the ambient temperature 2 C cooler than the Canyon but was almost 3 C warmer than Cooler Master's HAF 932. The tradeoff, of course, was realized in our acoustic measurements. Thermaltake's Spedo generated 47 decibels to the Canyon's 45 and the HAF's 52. The only way to counteract the give-and-take between heat and noise would be to skip air cooling altogether and take the liquid cooling route, which the Spedo also supports.

Is the Advance Package worth an extra $50? That's hard to say. The ATC 3 partitions are somewhat flimsy to install. We'd just as soon not use them at all. On the other hand, Thermaltake's cable management system is great, the side panel fan power contact is very cool, and the case's interior looks sharp through the plastic window. Extra fans don't hurt, either. Were the Spedo and its Advance Package priced similarly to Cooler Master's HAF 932, Thermaltake would unquestionably have an advantage. As it stands, the Spedo Advance Edition is just slightly overpriced. ▲

by Paul Cross

Spedo Advance Package
$249.99
Thermaltake
www.thermaltake.com
● ● ● ◖

Given its number of fans and thermal optimization through the A.T.C. 3 chamber system, we expected the Spedo to serve up exceptional performance.

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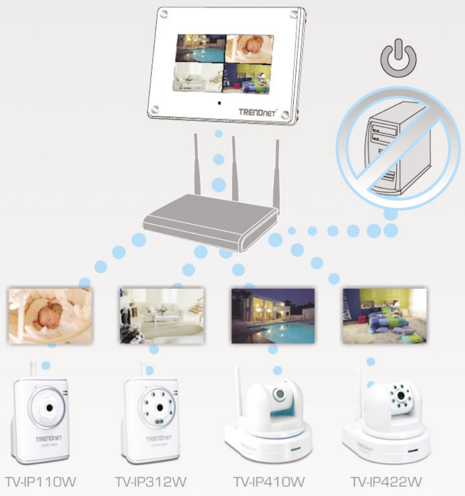

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Colossal High-End Graphics Card Clash

Nine Pixel-Pushing Powerhouses Do Battle

The graphics card market is in a constant state of flux with frequent product refreshes, perpetual price drops, new driver releases, and a never-ending tide of hot new games that sometimes perform differently on Nvidia and ATI GPUs. The good news for those of us with finite upgrade budgets is that these rapid product cycles mean that today's flagship graphics card may be relegated to the bargain bin tomorrow.

To help shed some light on the current state of the high-end 3D graphics card market, we've reviewed a number of cards ranging from the somewhat mainstream Radeon HD 4870 and GeForce GTX 260 Core 216 to the new, ultra high-end, dual-GPU-powered GeForce GTX 295. We've put all of the cards through the wringer with a barrage of games, in hopes of finding a clear choice for your hard-earned cash.

How We Tested

To assess the performance of the graphics cards in this roundup, we tested each one with a number of popular games and applications. The Enemy Territory: Quake Wars, Crysis, and Left 4 Dead tests were conducted with custom-recorded demos, using each game's built-in time demo options. The Unreal Tournament 3 and Fallout 3 tests were conducted using FRAPS run-throughs in UT3's Vehicle CTF "Suspense" and Fallout 3's outdoor "Dupont Circle" maps. The Far Cry 2 tests used the game's built-in benchmark tool with the included "Small Ranch" demo, and the 3DMark Vantage tests were run with the application's "Extreme" present option. We cranked up all of the in-game graphical options to their respective maximums for each game and tested the graphics cards at high resolutions to tax them as much as possible.

Asus ENGTX295

As its name implies, the ENGTX295 is Asus' interpretation of Nvidia's new dual-GPU-powered flagship GeForce GTX

Specifications

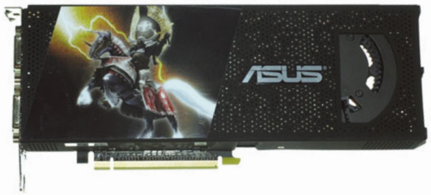
	Asus ENGTX295	Zotac GeForce GTX 280 AMP! Edition	Palit GeForce GTX 280	Asus EAH4870X2 TOP	Sapphire Radeon HD 4850 X2
GPU	GT200B	GT200	GT200	RV770 x 2	RV770 x2
Fabrication Process	55nm	65nm	65nm	55nm	55nm
Core Clock	576MHz	700MHz	602MHz	790MHz	625MHz
Processor cores	480 (240 x 2)	240	240	1,600 (800 x 2)	1,600 (800 x 2)
Processor core clock	1,242MHz	1,400MHz	1,296MHz	790MHz	625MHz
Frame buffer	1,796MB	1GB	1GB	2GB	2GB
Memory interface	448-bit (x 2)	512-bit	512-bit	256-bit (x 2)	256-bit (x 2)
Memory type	GDDR3	GDDR3	GDDR3	GDDR5	GDDR5
Memory clock	1,000 MHz	1,150 MHz	1,107 MHz	915 MHz	993 MHz
Memory data rate	2,000 MHz	2,300 MHz	2,214 MHz	3,660 MHz	1,986 MHz
Interface	PCI-E 2.0	PCI-E 2.0	PCI-E 2.0	PCI-E 2.0	PCI-E 2.0
Display connectors	DVI-D x 2, HDMI x 1	DVI-D x 2	DVI-D x 2	DVI-D x 2	DVI-D x 4
Video engine	Yes (PureVideo HD)	Yes (PureVideo HD)	Yes (PureVideo HD)	Yes (Avivo HD)	Yes (Avivo HD)
Multi-GPU capable	Yes (Quad-SLI)	Yes (SLI)	Yes (SLI)	Yes (CrossFireX)	Yes (CrossFireX)
Power connectors	6-pin x 1, 8-pin x 1	6-pin x 1, 8-pin x 1	6-pin x 1, 8-pin x 1	6-pin x 1, 8-pin x 1	6-pin x 1, 8-pin x 1
Form factor	Dual Slot	Dual Slot	Dual Slot	Dual Slot	Dual Slot
Board length (inches)	10.5	10.5	10.5	10.5	11
Price	$499	$349	$319	$599	$299
CPU rating	●●●●	●●●●	●●●◖	●●●	●●●

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

295. Other than affixing a custom decal to the card's fan shroud, however, Asus has done little to differentiate its ENGTX295 from other GeForce GTX 295 reference cards. The ENGTX295 features the same clock speeds as other reference cards for its pair of GT200B GPUs, as does its 1,792MB of GDDR3 memory.

The Asus ENGTX295's accessory bundle and warranty are somewhat bland in light of a couple of the other cards we've evaluated, as well. Included with the ENGTX295 are a pair of 6- and 8-pin power adapters, along with a DVI-to-VGA adapter, an S/PDIF audio passthrough cable, a users guide, driver and utility discs, and a pleather CD wallet. Sorry, no games included here. And the Asus ENGTX295 is covered by a three-year warranty, whereas some others sport a lifetime warranty.

Where the Asus ENGTX295 does stand out, however, is in regard to performance. Simply put, this dual-GPU monster is the fastest single graphics card we have ever tested, and it will likely remain so until Nvidia's board partners release factory overclocked models at some point in the future—or until AMD takes the wraps off its next-gen flagship.



ENGTX295
$499
ASUS
www.asus.com
●●●●

GeForce GTX 280 AMP! Edition
$349
Zotac
www.zotac.com
●●●●

GeForce GTX 280
$359
Palit
www.palit.biz
●●●◖

Zotac GeForce GTX 280 AMP! Edition

The Zotac GeForce GTX 280 AMP! Edition is arguably the most attractive GeForce GTX 280 we have yet come across. This card not only boasts some of the highest frequencies of any air-cooled GeForce GTX 280 (700MHz core, 1,400MHz shaders, 1,150MHz memory) but also comes with a streamlined overclocking application dubbed "Firestorm," which you can use to push frequencies—and performance—even further. The GeForce GTX 280 AMP! Edition also ships with a well-appointed accessory bundle that includes all of the usual suspects (users manual, driver CD, display output, and power adapters, etc.) in addition to a copy of Codemasters' racing sim GRiD.

Zotac goes the extra mile for the GeForce GTX 280 AMP! Edition's warranty, too. Although it includes a run-of-the-mill two-year warranty out of the box, simply registering on the company's Web site upgrades the warranty to lifetime coverage. Surprisingly, the Zotac GeForce GTX 280 AMP! Edition was also one of the lowest-priced GeForce GTX 280 cards available as of this printing. This card is a winner all around.

Palit GeForce GTX 280

Although Palit has a reputation for producing some of the wildest custom desktop graphics cards out there, the company took a rather conservative approach with its GeForce GTX 280 card. The Palit GeForce GTX 280 is a reference card through and through, the only exception being a custom decal affixed to the card's fan shroud. The Palit GeForce GTX 280's 602MHz core, 1,296MHz shader, and 1,107MHz memory clocks match Nvidia's reference design.

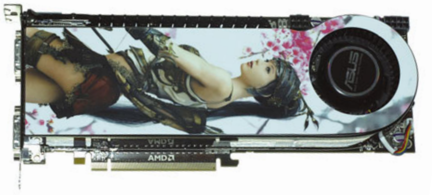
Palit's price is in line with most other GeForce GTX 280s, but the card's two-year warranty seems a bit lacking by comparison. Palit's accessory bundle helps its GeForce GTX 280 stand out somewhat, however; along with the card, Palit includes

Evga GeForce GTX 260 Core 216	Zotac GeForce GTX 260 Core 216 AMP2! Edition	HIS Radeon HD 4870 1GB IceQ 4+	Diamond Multimedia Radeon HD 4870 1GB
GT200	GT200	RV770	RV770
65nm	65nm	55nm	55nm
626MHz	650MHz	770MHz	750MHz
216	216	800	800
1,350MHz	1,400MHz	770MHz	750MHz
896MB	896MB	1GB	1GB
448-bit	448-bit	256-bit	256-bit
GDDR3	GDDR3	GDDR5	GDDR5
1,053 MHz	1,050 MHz	1,000 MHz	900 MHz
2,106 MHz	2,100 MHz	4,000 MHz	3,600 MHz
PCI-E 2.0	PCI-E 2.0	PCI-E 2.0	PCI-E 2.0
DVI-D x 2	DVI-D x 2	DVI-D x 2	DVI-D x 2
Yes (PureVideo HD)	Yes (PureVideo HD)	Yes (Avivo HD)	Yes (Avivo HD)
Yes (SLI)	Yes (SLI)	Yes (CrossFireX)	Yes (CrossFireX)
6-pin x 2	6-pin x 2	6-pin x 2	6-pin x 2
Dual Slot	Dual Slot	Dual Slot	Dual Slot
10.5	10.5	10.5	10.5
$289	$309	$296	$309
●●●●	●●●●	●●●●	●●●◖

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

a few usual items, such as a driver CD, a setup guide, PCI Express power adapters, and DVI-to-HDMI and -VGA adapters. In addition, Palit throws in a copy of Tomb Raider Anniversary. It may not be a game-of-the-year award winner, but we'll take it.

Asus EAH4870X2 TOP



EAH4870X2 TOP
$599
ASUS
www.asus.com
●●●

The Asus EAH4870X2 TOP is essentially a copy of ATI's reference design Radeon HD 4870 X2 card, with a few minor aesthetic and technical differences. The Asus EAH4870X2 TOP uses the same PCB and has the same cooler design as other 4870 X2 cards, but Asus puts its own spin on the cooler with a decal depicting a fetching warrior lady standing amid a shower of cherry blossoms.

Similar to other 4870 X2 cards, the EAH4870X2 TOP features a pair of ATI RV770 GPUs and 2GB of GDDR5 memory (1GB per GPU), but Asus increases the frequencies of both over stock reference models. The EAH4870X2 TOP's GPUs are clocked at 790MHz, and its memory comes in at 915MHz, up from 750MHz and 900MHz on stock Radeon HD 4870 X2 cards. The higher GPU and memory clocks give the EAH4870X2 TOP a boost in compute and fill rate performance, as well as peak memory bandwidth.

Asus bundles a handful of accessories with the EAH4870X2 TOP that includes driver and utility CDs, a leather CD case, a quick setup guide, a CrossFire bridge connector, 6- and 8-pin PCI-E power adapters, an HD component output dongle, and DVI-to-VGA, DVI-to-HDMI, and S-Video-to-composite output adapters. And Asus covers the card with a three-year warranty.

Sapphire Radeon HD 4850 X2

When AMD launched the ATI Radeon HD 4870 X2 back in August of last year, the company hinted at the imminent arrival of a more affordable version of the card with lower-clocked GPUs and GDDR3 memory; it was aptly called the Radeon HD 4850 X2. But it took a few months for the 4850 X2 to arrive at retail, and when it did, Sapphire was the only board partner to offer one. After evaluating the card, we think we understand why.

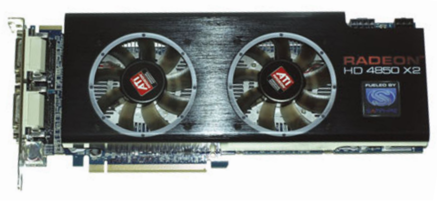
The Sapphire Radeon HD 4850 X2 was the only card we tested with quad

Performance

	Asus ENGTX295	Zotac GeForce GTX 280 AMP! Edition	Palit GeForce GTX 280	Asus EAH4870X2 TOP	Sapphire Radeon HD 4850 X2
3DMark Vantage (Extreme Preset - 1,920 x 1200, 4XAA, 16XAF)					
Overall Score	9074	5983	5762	7685	5835
GPU Score	8719	5798	5594	7520	5667
GPU Test 1 (FPS)	29.18	19.14	18.04	24.3	18.34
GPU Test 2 (FPS)	21.76	14.32	13.21	19.68	14.8
FarCry 2 v1.02 (Ultra HQ - 4X AA, 16XAF)					
1,920 x 1,200	69.13	52.6	51.84	65.01	56.9
2,560 x 1,600	49.53	37.77	36.43	45.29	34.56
Crysis v1.21 (Very High - No AA, No AF)					
1,920 x 1,200	40.27	28.25	27.87	40.33	30.78
2,560 x 1,600	26.52	17.8	17.42	26.95	19.14
Unreal Tournament 3 (HQ - No AA, No AF)					
1,920 x 1,200	136.21	122.58	119.87	126.41	121.78
2,560 x 1,600	119.99	82.14	80.96	107.82	83.45
Fallout 3 (Ultra HQ - 4XAA, 16XAF)					
1,920 x 1,200	70.58	71.11	70.91	69.18	69.15
2,560 x 1,600	70.51	68.67	68.34	69.03	67.25
Enemy Territory: Quake Wars (Ultra HQ - 4XAA, 16XAF)					
1,920 x 1,200	124.9	96.3	96.1	119.6	99.9
2,560 x 1,600	100.4	66.3	65.9	94.1	73.3
Left 4 Dead (High Quality - 4X AA, 16XAF)					
1,920 x 1,200	123.24	105.08	104.6	123.72	106.92
2,560 x 1,600	97.23	68.82	67.84	82.79	67.57
Total System Power Consumption (Watts)					
Idle	183	172	171	192	194
Load	420	346	342	459	396

Test System Hardware: CPU: Core 2 Extreme QX9775 @ 3.2GHz, **Motherboard:** Asus Striker II Extreme, **Memory:** 4GB Corsair DDR3-1333, **Hard Drive:**
Software: OS: Windows Vista Ultimate SP1 32-bit, **Nvidia drivers:** GeForce Release v180.87, **ATI driver:** Catalyst v8.12, **DirectX Redist** November 200

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT



Radeon HD 4850 X2
$329
Sapphire
www.sapphiretech.com
●●●

DVI output, and it is obviously very powerful, with a pair of RV770s and 2GB of memory onboard (a 1GB model is also available). In our tests, the card performed on par with or slightly better than the GeForce GTX 280, which is no small feat. But its cooling solution is rather loud, and its 11-inch PCB is relatively long and could pose clearance problems in some midtower cases, somewhat limiting its appeal. The Sapphire Radeon HD 4850 X2 is also a complex card that is more difficult and more costly to produce than the slightly slower, but similarly priced 1GB Radeon HD 4870.

Sapphire offers a two-year warranty on the 4850 X2 and bundles it with a slew of accessories, including CyberLink's PowerDVD and DVD creator suite, Ruby Rom Volume 1.1, 3DMark Vantage, drive and utility CDs, a users manual, a case badge, a CrossFire bridge connector, and numerous display output and power adapters. If you don't mind the relatively loud cooling solution and it'll fit in your case, the Sapphire Radeon HD 4870 X2 is a great option for gamers who can't afford to buy a card in the upper echelon. Otherwise, we think you may be better served by a quieter GTX 280 or more affordable 1GB 4870.

Evga GeForce GTX 260 Core 216 Superclocked Edition

With the exception of its Core 216-branded decal on the fan shroud, Evga's GeForce GTX 260 Core 216 Superclocked Edition looks essentially identical to the company's first-gen GeForce GTX 260. The card features the same cooler, PCB, and dual, dual-link DVI outputs. The GPU on the Evga GeForce GTX 260 Core 216 Superclocked Edition card, however, is clocked at 626MHz, with a 1,350MHz shader clock for its 216 processor cores, and 896MB of 1,053MHz (2,106MHz DDR) memory. The greater number of stream processors, in conjunction with the card's higher clock speeds, give it a nice performance boost over legacy GeForce GTX 260 cards.

Evga bundles the GTX 260 Core 216 Superclocked Edition with a users manual and driver CD, a DVI-to-VGA adapter, a DVI-to-HDMI adapter, an S/PDIF audio cable for feeding digital audio into the card, and two Molex-to-6-pin PCI Express power adapters. Evga also includes a copy of its Precision Overclocking Utility, and when users register the card, a free copy of 3DMark Vantage Advanced Edi-tion also becomes available for download. Finally, this card is covered by Evga's ex-cellent lifetime warranty and happened to be the least expensive card we tested in this roundup, as well.

EVGA GeForce GTX 260 Core 216	Zotac GeForce GTX 260 Core 216 AMP2! Edition	HIS Radeon HD 4870 1GB IceQ 4+	Diamond Multimedia Radeon HD 4870 1GB
4938	4996	4173	4106
4722	4763	4028	3924
15.93	16.31	13.07	12.98
11.66	11.98	10.48	10.24
44.45	46.51	41.5	42.26
31.1	32.9	28.27	27.33
23.18	23.97	23.53	23.07
14.74	15.61	14.77	14.12
109.41	111.2	100.71	99.84
69.63	72.84	63.61	62.87
69.88	70.06	69.84	69.27
64.41	64.76	64.22	64.03
90.5	92.1	89.7	89.4
56.7	58.8	55.7	55.1
88.64	90.16	81.27	80.46
57.27	59.39	50.37	49.12
173	175	176	173
311	316	282	279

3-1333, **Hard Drive:** Western Digital Raptor 150GB, **PSU:** PC Power & Cooling Turbo-Cool 1200
ber 2008

Zotac GeForce GTX 260 AMP2! Edition

Zotac's GeForce GTX 260 AMP2! Edition is physically similar to Evga's GeForce GTX 260 Core 216 but with a different decal affixed to its fan shroud. The two cards' specifications do differ somewhat, however. Zotac outfits its GTX 260 AMP2! Edition card with a slightly higher 650MHz GPU clock, a 1,400MHz shader clock, and 1,050MHz (2,100MHz DDR) memory.

The Zotac GeForce GTX 260 AMP2! Edition's bundle includes a similar assortment of items to Evga's, as well: a users manual and driver CD, a DVI-to-VGA adapter, a DVI-to-HDMI adapter, an S/PDIF audio cable, and two Molex-to-6-pin PCI-E power adapters. In addition to those items, though, Zotac throws in an HD component output dongle and a full version of the excellent driving game GRiD.

Out of the box, Zotac's warranty covers the card with a two-year warranty, but as with the GTX 280 AMP! Edition card, if owners register their cards on the Zotac Web site, Zotac upgrades them to a lifetime warranty.

HIS Radeon HD 4870 1GB IceQ 4+

HIS has a long history of taking ATI's reference designs and tweaking them slightly in an effort to help differentiate its cards from those of the competition. HIS typically uses more brightly colored PCBs, higher-clocked GPUs and memory, and even custom coolers on many of its cards. The HIS Radeon HD 4870 1GB IceQ 4+, for example, sports a blue PCB, rather than the red you'll see on most other Radeon HD 4870s. Its GPU clock is a speedy 770MHz, and its 1GB of GDDR5 memory runs at an effective 4GHz. The HIS Radeon HD 4870 1GB IceQ 4+ also has a custom UV-reactive cooling system with copper heatsinks and heatpipes that's not only more powerful than ATI's reference design, but is quieter, too.

Although HIS takes steps to ensure its hardware stands out, the IceQ 4+'s accessory bundle is anything but extraordinary. Along with the card, we found a basic quick-start guide, a case badge, a couple of display output and power adapters, a CrossFire bridge connector, and a driver CD—no games, content creation programs, or benchmarking applications were included. HIS offers a three-year warranty with the card, which isn't bad, but it isn't a lifetime warranty like Evga's, either. Being conservative with the bundle and warranty, however, gives HIS the ability to price the card competitively at slightly under $300. Considering its performance and features, this is a great card for the money.

Diamond Multimedia Radeon HD 4870 1GB

Diamond Multimedia's Radeon HD 4870 1GB is a carbon copy of AMD's reference design, like most other Radeons. Every aspect of Diamond's card is identical to AMD's own ATI Radeon HD 4870 1GB card, including GPU and memory clock speeds (750MHz and 900MHz, respectively) and the cooler design. Diamond does, however, install a custom decal on the fan shroud which looks pretty cool, but even then it sports the likeness of ATI's digital superstar, Ruby, and not one of Diamond's well-known brands, such as the Viper or Stealth.

Similarly, Diamond does little to differentiate this card's bundle and warranty from the competition. Short of a coupon included in the box to download 50 free MP3s from emusic.com, there's nothing thrown in to get excited about. Like the other cards we've looked at here, the Diamond 4870 came with driver CD, manuals, and some adapters, but not much else. And Diamond covers the card with only a one-year warranty, which is the shortest of the bunch. Diamond Multimedia is a trusted brand with a long history, and its Radeon HD 4870 1GB is a killer graphics card, but it's hard to get excited about this card in light of its more affordable, unique, and less expensive competition.

295 Comes Correct

After conducting our tests, there was clear delineation at the ultra-high end, but the more mainstream cards performed similarly. The dual-GPU powered Asus ENGTX295 was the fastest card overall, followed by the Asus EAH4870X2 TOP. The two GeForce GTX 280 cards from Zotac and Palit traded victories with the Sapphire Radeon HD 4850 X2, as did the GeForce GTX 260 Core 216-powered cards and the 1GB Radeon HD 4870 cards.

Overall, the GeForce GTX 260 Core 216 and 1GB Radeon HD 4870 cards seem to offer the best value, with each offering solid frame rates at relatively low prices. Of the cards we tested, the Evga GeForce GTX 260 Core 216 and HIS Radeon HD 4870 1GB IceQ 4+ would be our top picks factoring in price for performance. Looking at the numbers alone, the Sapphire Radeon HD 4850 X2 also seems to be a good choice with its sub-$300 price tag and strong performance, but we encountered some instability with the card when testing at 2,560 x 1,600 with Crysis and UT3, and its 11-inch PCB may pose a clearance problem with some mid-tower cases. If you have the funds, the Asus ENGTX295 and EAH4870X2 TOP are the cream of the crop, and don't forget any one of these cards can be paired up with a similar model for even better performance when running in SLI or CrossFire. ▲

by Marco Chiappetta

GeForce GTX 260 Core 216 Superclocked Edition
$289
Evga
www.evga.com
●●●●

Radeon HD 4870 1GB IceQ 4+
$296
HIS Digital
www.hisdigital.com
●●●●

GeForce GTX 260 AMP2! Edition
$309
Zotac
www.zotac.com
●●●●

Radeon HD 4870 1GB
$309
Diamond Multimedia
www.diamondmm.com
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GMC R-4 Bulldozer

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GMC
www.gmc.co.kr
●●●◖

Specs: Bays: 1 5.25-inch external, 2 3.5-inch internal; Fans: 2 (+1 optional) 80mm, 1 120mm. Front ports: 2 USB, Audio I/O; Dimensions: 16.3 x 7.0 x 14 inches (HxWxD)

Someone once said that good things come in small packages. In terms of computer cases, GMC's R-4 Bulldozer is pretty small, so it's no wonder that it's full of good things.

The Bulldozer measures about 16 inches high and 14 inches deep. It weighs approximately 14 pounds. Its diminutive build can be attributed to its most inventive feature, the vertical-loading disc drive. Instead of a horizontal bay eating up space inside the chassis, the 5.25-inch bay is mounted vertically under the front panel. A handy lever acts as the open/close button and propels the disc tray downward. Quite cleverly, the whole process resembles the lowering of a bulldozer's blade.

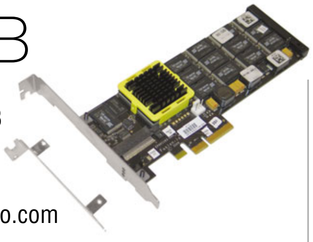
Despite its small size, the Bulldozer can house an ATX motherboard, but you have to do a bit of finagling to get a larger board situated. We suggest removing the HD cage right away to make room for the board. Surprisingly, working inside the Bulldozer was easier than expected. There was plenty of room for all our components, including our 10-inch graphics card. You'll have to have some decent cable management skills, however, because too many stray cables in such a small space will hinder airflow.

Speaking of airflow, the Bulldozer is equipped with a 92mm front fan accented with a red LED. Overall noise level for all the case fans was low. An 80mm fan on the side panel has its own speed control, and each of the two speeds corresponds to two flashing red and green lights. On the slower speed, the lights alternate blinking at a slower rate than when set to the higher speed. Speed control is a nice touch, but the flashing lights are a bit annoying if you have the case on the desktop next to you. In order to disable them, you'll have to remove part of the side panel and toy with the small circuit board that operates the side fan, lights, and one of two temperature displays. (The other display is located on the front panel.)

The Bulldozer is a functional, lightweight chassis perfect for those with little desk space or those who need an easy-to-carry LAN sidekick. The vertical-loading disc drive bay makes the Bulldozer unique, but the external moving parts that open the drive make us question how well this case will hold up to frequent LAN travel. ▲

by Kris Glaser

Fusion-io ioDrive 80GB



ioDrive 80GB
$2,995
Fusion-io
www.fusion-io.com
●●●●◖

Specs: 700MBps read/550MBps write (16KB, random); 0.05ms read access time; 88,000 IOps (4KB, 70% read/30% write); 7.5 watts; 24 years/5TB daily write/erase; HDD activity LED header; 3-year warranty

Here's the bombshell that rocked the storage world: an x4 PCI-E SSD with performance off the scale. Instead of in a drive-sized box with a SATA or PATA interface, the remarkable new ioDrive comes as an expansion card.

Like most high-performance SSDs available to consumers—none of which currently comes even close to this one's raw speed and ultra-low latency—the RAID-able Samsung SLC NAND-based ioDrive will show its full awesomeness in a high I/O environment. Still, it's enough of a leap ahead in sequential reads/writes to make PC enthusiasts cast speculative eyes upon their credit cards. You'll need a 64-bit Linux or Windows XP/Vista/2003/2008 system to use the ioDrive, and Fusion-io recommends at least 2GB of free RAM for every 80GB.

The benchmark scores speak volumes. No, there are no misplaced decimal points.

Our test PC was an Alienware Area-51 X-58. For comparison, we benched the PC's boot drive, an SSD RAID. HD Tune results weren't overly consistent, but the results we did eke out were phenomenal.

The only serious con is that the ioDrive isn't bootable. Then there's the price. Steep for you and us, perhaps, but it's actually a bargain for enterprise admins looking to trade out huge arrays of hard drives. In comparison, capacity gulf notwithstanding, the ioDrive certainly is a miser regarding power, space, and heat. An SLC 160GB unit goes for $7,200, and an MLC 320GB ioDrive sells for $14,400.

Make no mistake: The game has changed.

(*Special thanks to distributor DV Nation.com.*) ▲

by Marty Sems

Benchmark Results

Drive	ioDrive 80GB	Samsung (2x, RAID 0)
PCMark Vantage 1.0.0 (Nov 07 patch; NTFS)		
HDD Score (points)	91816	18701
Defender (MBps)	413	91
Gaming (MBps)	392	79
Photo Gallery (MBps)	482	200
Vista Startup (MBps)	562	97
Windows Movie Maker (MBps)	356	63
Windows Media Center (MBps)	522	101
WMP (MBps)	338	56
App Load (MBps)	407	68
HD Tune Pro 3.10		
Read rates, avg/max (MBps)	553/589	126/189
Write rates, avg/max (MBps)	452/456	n/a
Access time R/W (ms)	0/0.1	0.2/n/a
Burst rate R/W (MBps)	407/260	155/n/a
Iometer 2006.07.27 (NTFS)		
File Server (IOps)	19587	1258
File Server (MBps)	212	14
File Server avg/max response (ms)	0.8/352	13/741
Web Server (IOps)	39396	5778
Web Server (MBps)	602	89
Web Server avg/max response (ms)	1.6/641	11/54

Test system specs: Intel Core i7-965 Extreme 3.2GHz, Asus P6T Deluxe, 12GB DDR3-1066, Vista Home Premium 64-bit SP1; ioDrive driver 1.2.1

CPU RANKING ○ **0 = ABSOLUTELY WORTHLESS** | ●●◖ **2.5 = ABSOLUTELY AVERAGE** | ●●●●● **5 = ABSOLUTELY PERFECT**

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GMC X-7 X-Station

GMC is a Korean manufacturer—not to be confused with the American-made General Motors Corporation—marking its territory with unique case construction and showy exterior designs. Fittingly, the X-7 X-Station is no exception: It provides the basics without sacrificing novelty.

To jump right in, we didn't encounter any major installation obstacles in this ATX case, but we did take note of the absence of a PSU bridge, neither stationary nor adjustable. Without this support, you'll have to temporarily secure the PSU (i.e. hold it with one hand) while screwing it into place. We were also slightly disappointed by the lack of tool-less features or rubber grommets for insulation.

As far as aesthetic appeal goes, the X-7 is a dark and brooding chassis. Its sharp bevels, well-defined lines, and protruding vents make an almost ominous impression, similar to a computing device you might see on board a ship from any film in the "Alien" series. In contrast to its all-black design, there are multiple LED lights for both flash and function. The red LED display on the front panel gauges the system temperature, as well as fan speed (as a percentage). The orange lights flanking either side of the 3.5-inch drive bay don't seem to serve any purpose, while dual LEDs, indicating HDD activity and power, reside on the left panel next to the integrated fan controller.

Most interestingly, GMC has added a second power switch, located on the left corner of the top panel, for users who prefer to store their tower on the floor. Although this is a nice touch, we wish there were more I/O ports, such as eSATA and FireWire. There is plenty of ventilation, however, as well as a single 5.25-inch bay.

The X-7 provides a practical form factor along with some distinct extras. Even though it does have a few irregularities, it's a quality chassis for a midrange system. ▲

by Joanna Safford

X-7 X-Station
$129.99
GMC
www.gmc.co.kr
●●●

Specs: Bays: 4 5.25-inch internal, 5 3.5-inch internal, 1 5.25-inch external; Fans: 1 120mm (front), 1 120mm (rear), 1 80mm (side panel); Dimensions: 425 x 190 x 420mm (HxWxD); 4 USB ports

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OCZ Technology DDR3 PC3-12800 Platinum

There's nothing like a major platform update from Intel to infuse the market with interesting new products in support of that "ecosystem," as so many PR types like to call it. The Intel Core i7's triple-channel memory controller requires matched, three-DIMM DDR3 kits for the best performance. In addition, lower-power 1.65V modules are required, whereas 1.9V kits were the norm for Core 2 dual-channel setups. The good news is with that third memory channel in play, you get a lot more memory bandwidth for the Core i7—upwards of 18GBps (and that's at standard DDR3-1066 speeds).

With the mainstream market gradually shifting to 3GB and 6GB DDR3 kits, OCZ has been hard at work revamping its product line with low-voltage offerings for Intel's X58/Core i7 platform. We tested the OCZ3P1600LV6GK Platinum XTC Triple Channel kit, which is rated for DDR3-1600 performance at latency settings of 7-7-7-24 at a stock voltage of 1.65V. This 6GB kit is a derivative of OCZ's standard Platinum series lineup and has a pretty reasonable price tag of $249. That's about $40 per Gig, which is a decent value when you consider lower density 2GB module kits average about $35 per GB. The 6GB Platinum XTC kit consists of three 2GB modules with standard aluminum heat spreaders that are coated with a bright platinum-colored finish. Under normal operation and even a bit of overclocking, these modules only got slightly warm to the touch, so the cooling is adequate.

In terms of performance, these modules dialed up to their rated speeds easily on various X58 Express motherboards that we tested; we ran our benchmarks and overclocking on Evga's X58 3X SLI motherboard. At stock speeds and latency settings, we chalked up a blistering 26GBps+ of average bandwidth in Sandra's Memory Bandwidth test. In addition, we were able to goose voltages up a few notches to 1.85V and found stability at DDR3 1800MHz CL7-7-7-24.

All told, you get what you pay for and then some with this 6GB triple-channel DDR3 kit. ▲

by Dave Altavilla

Benchmark Numbers

	Rated Speeds (DDR3-1600, 7-7-7-24, 1.65V)	Overclocked Speeds (DDR3-1800, 7-7-7-24, 1.85V)
SANDRA 2009		
Memory Bandwidth Test		
Int Buffered iSSE	26.88GBps	30.18GBps
Float Buffered iSSE2	26.94GBps	29.42GBps

Test System Specs: 3.2GHz Intel Core i7 Extreme 965, 3GB DDR3-1066, WD Raptor 150G, GeForce GTX 280, Windows Vista Ultimate 64-bit

DDR3 PC3-12800 Platinum
$249
OCZ Technology
www.ocztechnology.com
●●●●

Specs: Capacity: 6GB (3x 2GB); Timings: 7 (CAS), 7 (tRCD), 7 (tRP), 24 (tRAS), 2T (Command Rate); Voltage: 1.65V; lifetime warranty

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

AMD Phenom II X4 940 Black Edition

Phenom II X4 940 Black Edition
$275
AMD
www.amd.com
●●●

Specs: Socket AM2+ 940; Clock speed: 3GHz; HyperTransport 3.0 Link: 3.6GHz full duplex; 45nm process; Cache: 2MB total dedicated L2 cache, 6MB L3 cache; 125W max TDP

Phenom II X4 940 BE
Test system specs: Processor: 3GHz AMD Phenom II X4 940 Black Edition; RAM: 2GB Qimonda DDR3-1067 CL7; Graphics: ATI Radeon 4850; Hard drive: 150GB Western Digital Raptor 1500

Core i7-965
Test system specs: Processor: 3.2GHz Intel Core i7-65 Extreme Edition; RAM: 3GB Qimonda DDR3-1067 CL7; Graphics: Nvidia GeForce GTX 280; Hard drive: 150GB Western Digital Raptor 1500

The rise of the Dragon is upon us. With the release of the Phenom II processors, the third component of AMD's new Dragon platform is in place. The Phenom II joins the 4800 HD series graphics and 7-Series chipsets to complete the platform.

I hoped that the best Phenom II would perform better than the meek original Phenom I, and indeed it did. Across the board, the new CPU outperforms its little brother by a long shot. AMD apparently figured something out between the original Phenom release and now. (It's no surprise that the Phenom II was released so shortly after the Phenom.) It's a better CPU, and it fits nicely with the Dragon platform.

What's interesting is that nothing has fundamentally changed (other than the 45nm process) from the Phenom I. That said, the Phenom II's performance still lags behind the the top chips from a certain bluish competitor; but AMD knows that and has priced the Dragon components accordingly. This is AMD's top-of-the-line HD gaming and productivity CPU, but as with many AMD processors of late, this one comes with a caveat: "at an affordable price." (Reading between the lines, one might consider that a euphemism for "This is a budget CPU.")

Nevertheless, there are plenty of good things to say about the Phenom II. The system ran surprisingly quietly even when heavily overclocked—a nice bonus for those who will use this CPU in double-duty gaming/home-theater applications and want to keep their machine quiet.

Further, the Phenom II X4 940 has a decent amount of headroom for overclocking: I was able to hit just a hair below 3.7GHz and scored P7556 in 3DMark Vantage. And just about every conceivable BIOS feature is unlocked, giving the overclocker a smorgasbord of ways to push the system to its performance limit.

Finally, the socket AM2+ Phenom II processors will be forward-compatible with the upcoming AM3 socket and will support both DDR2 and DDR3. This effectively lets users upgrade their systems piecemeal, which is always a nice treat.

For $275, the Phenom II X4 Black Edition *is* a pretty good deal for a pretty good processor. If you want to build a solid gaming system, the Phenom II is a fine place to start. And when you consider the cost of the Phenom II in the context of a whole Dragon-based system, the whole shebang is quite a value. ▲

by Seth Colaner

Benchmark Numbers

	AMD Phenom X4 940 Black Edition	Intel Core i7-965
3DMark Vantage		
Overall (1,280 x 1,024)	P7214	P12465
GPU	6564	10030
CPU	10260	45858
PCMark Vantage Pro		
Overall	5917	6726
Memories	4205	5602
TV And Movies	4273	4788
Gaming	5410	8591
Music	5223	5672
Communications	5535	5524
Productivity	5213	5539
HDD	3433	3977
WinRAR 3.71*	2:30	1:25
Cinebench 10*		
Multithreaded (min:sec)	1:30	0:56
Multithreaded (score)	9786	15627
Crysis 1.1		
Low quality	93.81	156.93

** minutes:seconds*
*** Games tested at 1,280 x 1,024*

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

CoolIT Systems Domino A.L.C.

Domino A.L.C.
$79
CoolIT Systems
www.coolitsystems.com
●●●●

Liquid-cooling systems have had only limited acceptance in the mainstream market, based in part on the belief that they're expensive, difficult to install and maintain, and potentially dangerous due to leaks. All of these things can be true, but liquid cooling a PC has certainly become easier, safer, and far more affordable in recent years.

If you need proof that liquid cooling is ready for mainstream acceptance, look no further than CoolIT Systems' Domino A.L.C. (Advanced Liquid Cooling). The Domino A.L.C. is a completely self-contained, prefilled, liquid-cooling system consisting of a pump, radiator, fan, tubing, and waterblock. CoolIT designed the Domino A.L.C. to be affordable while addressing all of the major concerns mentioned earlier. Through the use of less permeable materials, an easy-to-mount radiator and control assembly, and a nearly universally compatible waterblock with factory-installed TIM, the Domino A.L.C. requires almost no maintenance and can be installed in the same amount of time as many high-end air coolers.

The Domino A.L.C. offers three modes: Quiet, Performance, and Full. In Quiet mode, the unit's fan spins at low RPM, which produces almost no noise but also limits cooling performance. Full mode was excessively loud (and unnecessary for most circumstances). Performance mode was perfectly tolerable, however, and offered excellent performance.

While testing the Domino A.L.C. on a Core i7 965 Extreme-based system, it offered idle and load temperatures of 42 degrees Celsius/53 C in Quiet mode, 41 C/49 C in Performance mode, and 40 C/45 C in Full mode, respectively. Compare this to 43 C and 60 C with a stock Intel cooler. It also let me run the CPU at a stable 4GHz.

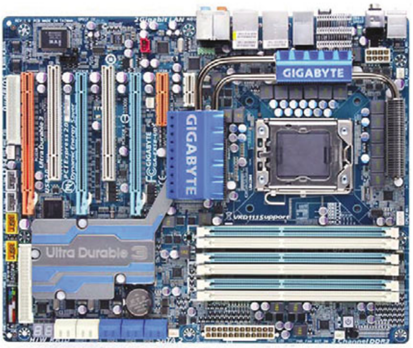
If you're toying with the idea of liquid cooling but want to dip your toes in the water before cannon-balling into the deep end, check out the Domino A.L.C. ▲

Specs: Compatibility: Intel Sockets LGA 775/1366, AMD Sockets 940/AM2/AM2+; Radiator dimensions: 157 x 133 x 25mm (HxWxD); Fan: 120mm diameter, 1,100 to 2,900rpm; Acoustics: 19.2 to 39.4dBA

by Marco Chiappetta

Gigabyte GA-EX58-UD5

GA-EX58-UD5
$299
Gigabyte
www.gigabyte-usa.com
●●●◖



Immediately following the introduction of Intel's Core i7, motherboard manufacturers were at the ready with a full lineup of enthusiast products built around the companion chipset for the Core i7, the X58 Express. And although Gigabyte's GA-EX58-UD5 is also targeted at enthusiasts, its sub-$300 street price makes it more accessible than many other X58 Express-based boards.

The GA-EX58-UD5's price positions somewhere in the middle of the X58 Express motherboard market, but its features set it apart. This board supports a host of high-end features, such as 3-Way SLI and CrossFireX, dual Gigabit LAN, and numerous RAID modes. Its BIOS is rife with overclocking options. The GA-EX58-UD5's layout is also quite good, with virtually all of its major connectors and headers color-coded and positioned around the edges of the board. Gigabyte also outfits the GA-EX58-UD5 with dual BIOS chips, an elaborate cooling apparatus with heatpipes, and 2 ounces of copper insulating layers within the PCB, which the company claims reduces circuit impedance and increases power efficiency.

The GA-EX58-UD5's BIOS is well-organized and designed with overclockers in mind. The M.I.T. (MB Intelligent Tweaker) holds all of the frequency, multiplier, and voltage manipulation tools, and Gigabyte includes its Windows-based Easy Tune 6 overclocking application with this board. Overclocking the GA-EX58-UD5 proved to be very easy, as I was able to hit a 182MHz base clock with no voltage tweaking.

Performance with the Gigabyte GA-EX58-UD5 was also quite good. With a Core i7 965 Extreme and 3GB of Corsair DDR3, this board posted a score of 6821 PCMarks in PCMark Vantage and 15,820 points in a multithreaded Cinebench R10 run. It also put up 198.55 FPS in a low-res Crysis CPU benchmark. Stability was also rock-solid throughout testing. This is a great motherboard for those interested in building a new machine around one of Intel's new Core i7 processors. ▲

Specs: Socket 1366; Chipset: Intel X58 Express; Max memory: 24GB (DDR3-800/1066/1333/2100+); Audio: Realtek ALC889A HD codec; Dual Gigabit LAN; RAID 0, 1, 5, 10; eSATA (with adapter); Slots: 3 PCI-E x16, 1 PCI-E x4, 1 PCI-E x1, 2 PCI 2.2; CrossFireX and SLI support

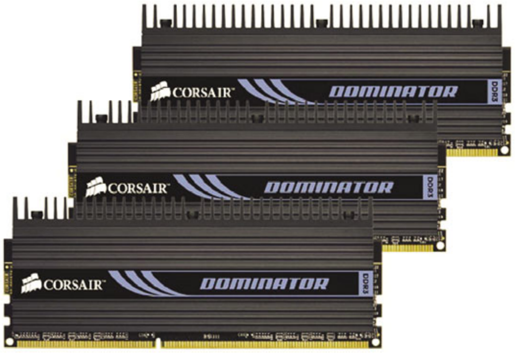
by Marco Chiappetta

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

Corsair Dominator TR3X6G1600C8D

To coincide with the launch of Intel's Core i7 processors, memory manufacturers released triple-channel DDR3 memory kits to fully exploit the performance capabilities of the platform. Corsair's Dominator TR3X6G1600C8D, for example, consists of three matched 2GB DDR3 memory modules. The sticks can operate at their rated frequency of 1,600MHz with 8-8-8-24 timings and a supply voltage of only 1.65V, which is the maximum voltage Intel recommends for the Core i7's integrated memory controller.

The Dominator TR3X6G1600C8D memory uses the company's DHX (Dual-path Heat Xchange) technology, but unlike earlier Dominator kits, the TR3X6G1600C8D features heavier heatsinks that are linked to a single array of fins along the top. Previous Dominator kits featured four independent heatsinks, each with their own array of fins.



Performance of the Dominator TR3X6G1600C8D memory kit was expectedly very good. While running at their rated frequency, this Dominator kit offered 27.1GBps of bandwidth according to SiSoft Sandra 2009 and a low-res Crysis benchmark yielded 211fps with a Core i7 965 Extreme and GeForce GTX 280 installed in the test system. Overclockers should also know that we were able to push the Dominator TR3X6G1600C8D to hit 1,720MHz without tweaking its voltage.

We've come to expect high performance and great stability from Corsair's Dominator memory kits, and the TR3X6G1600C8D doesn't disappoint. Consider this a solid match for any Core i7 processor. ▲

by Marco Chiappetta

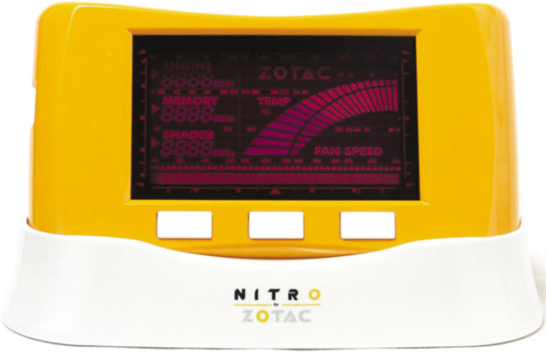
Dominator TR3X6G1600C8D
$269
Corsair
www.corsair.com
●●●◖

Specs: Capacity: 6GB (3x 2GB); Timings: 8 (CAS), 8 (tRCD), 8 (tRP), 24 (tRAS), 2T (Command Rate); Voltage: 1.65V; lifetime warranty

Zotac Nitro

It's not often that video card manufacturers do something truly innovative to help their products stand out in a sea of similar cards based on a reference design, but Zotac is trying to differentiate its products with a new gadget dubbed the Nitro Hardware OC Controller.

The Nitro is a USB device that gives users the ability to monitor their graphics card's temperature and over- or underclock their card at the touch of a button. The Nitro isn't included with any of Zotac's graphics cards currently, but the company will likely be bundling it with some AMP! Edition cards at some point in the future. For now, Zotac sells the Nitro as a standalone product that can be used to overclock Zotac-branded GeForce graphics cards. It works in conjunction with Zotac's downloadable Firestorm utility, which is a tiny performance tuning application that features sliders for fan speeds and GPU core, Shader, and memory frequencies.



With the Firestorm application running and the Nitro plugged into a USB port, the controls on the front of the Nitro can alter frequencies or fan speeds on the fly, even if a game is already running. You can save custom profiles, and a graphical readout on the Nitro's display shows GPU temperature readings in real-time. Non-Zotac GeForce users should know that holding the SHIFT key when launching the Firestorm application will let it work with any manufacturer's GeForce, however.

Zotac's Nitro isn't for everyone. Nvidia's nTune application already offers a host of overclocking tools for GeForce owners, and it's available free. That fact doesn't hinder the appeal of having a desk-bound gizmo that lets users overclock on the fly from within any game or application without having to access the driver control panel though. It's difficult to justify spending 100 bucks on a tool designed to overclock a graphics card, but we all know a hardware junkie or two that would love to show off one of these things on his desk. ▲

by Marco Chiappetta

Nitro
$99
Zotac
www.zotac.com
●●◖

Specs: Interface: USB 2.0/1.1; Device capabilities: GPU core, shader, and memory clock adjustments, fan speed control; temperature monitoring

Nvidia GeForce GTX 295

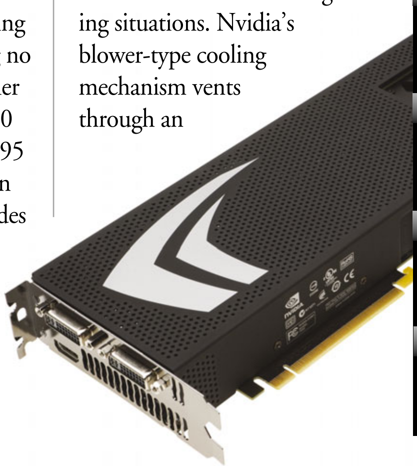
AMD's graphics division went on a rampage in the second half of 2008. It came out swinging with high-end Radeon HD 4870 and 4850 cards. Then, it bested Nvidia's flagship with the Radeon HD 4870 X2. Finally, AMD filled in some of the blanks on its mainstream roster with the Radeon HD 4830, the 4670, and the 4550. For the first time in a while, the two graphics vendors were able to square off in every market segment, from top to bottom.

Of course, that's not a satisfactory position for Nvidia, especially considering the success of its GeForce 8800 cards, followed up by the compelling performance of its GeForce GTX 280. Unfortunately, manufactured at 65nm, the large GT200 GPU driving that flagship board would have been difficult to cool on a dual-processor card, like the GeForce 9800 GX2. Nvidia had no real recourse except 2- and 3-Way SLI—until now.

Nvidia is starting to shift manufacturing to TSMC's 55nm node, and it's wasting no time pairing up GT200 GPUs for another run at the single-card crown. The GT200 GPUs on Nvidia's new GeForce GTX 295 sport specifications that fall right between GeForce GTX 260 and 280. Each includes 240 shader processors and 80 texture units, like the 280 running at full strength. Only seven frame buffer partitions are active though, yielding a memory configuration more like the GTX 260, with 28 ROPs and 896MB of GDDR3 on a 448-bit memory bus. Nvidia runs its core, shaders, and memory at GTX 260 speeds, too (576MHz, 1,242MHz, and 1,998MHz, respectively).

But put two such chips on the same board, connected by an internal SLI connector, and you're looking at theoretical performance far in excess of anything the company currently sells. Far Cry 2, Call of Duty: World at War, Left 4 Dead, and Dead Space all favor the GTX 295's pair of GT200s. The Radeon HD 4870 X2 is able to nearly keep pace in Crysis.

Two principal concerns arise when you pack a pair of 1.4 billion-transistor chips into the same two-slot form factor previously needed to host just one processor: power and noise. Nvidia claims that much of its effort in shifting to 55nm was directed at maximizing performance per watt. And almost amazingly, at 200W, the GeForce GTX 295 idles only 21W higher than a GeForce GTX 280 and 10W lower than AMD's Radeon HD 4870 X2. Perhaps even more incredibly, the two GT200s under load use 335W, about 15W more than the 280 and a full 50W less than AMD's flagship.



The GTX 295 isn't a noisy card at idle. Then again, neither is its principle competition. The GTX 295 card differentiates itself in more intense gaming situations. Nvidia's blower-type cooling mechanism vents through an exhaust grate in the dual-slot card and also out the top, recirculating some warm air back into your chassis. Although hardly ideal, the resulting effect is effective heat dissipation at a noticeably lower volume than the Radeon HD 4870 X2 in its stock form. Granted, the Catalyst Control Center does facilitate manual fan adjustment.

Nvidia's goal with its GeForce GTX 295 is to reclaim the single-card performance title. In most of the benchmarks we ran, it does outperform AMD's fastest board. Prices on the two dual-chip contenders should be fairly similar: the 4870 X2 already sells for roughly $500, and Nvidia says its GeForce GTX 295 will be priced at $499. From a purely frame rate-oriented standpoint, the green team has a definite advantage.

But it's also time to start considering some of Nvidia's other value-adds. We're not quite ready to jump onboard with the utility of PhysX, given an anemic list of popular games supporting the technology.

Benchmark Numbers

	Nvidia GeForce GTX 295	AMD Radeon HD 4870 X2
Far Cry 2		
1,920 x 1,200, 4XAA	81	75
2,560 x 1,600, 4XAA	59	50
Crysis		
1,920 x 1,200, 4XAA	30	29
2,560 x 1,600, 4XAA	3	15
Call of Duty: World at War		
1,920 x 1,200, 4XAA	104	95
2,560 x 1,600, 4XAA	88	69
Left 4 Dead		
1,920 x 1,200, 4XAA	141	123
2,560 x 1,600, 4XAA	99	80

But we have played Left 4 Dead on the GTX 295 using Nvidia's stereo 3D glasses, and the experience is literally game-changing. Chalk up another reason why we'd go the Nvidia route for high-end gaming, at least until AMD makes a shift to 40nm. ▲

by Paul Cross

Specs: GPU: GeForce GTX 295; Core clock: 576MHz; Memory: 896GB DDR3 (999MHz); 240 shader processors

Test system specs: 3.2GHz Intel Core i7 965 Extreme; 6GB Corsair Dominator DDR3-1600; Asus Rampage II Extreme; 1TB Seagate Barracuda 7200.11; GeForce 180.87 beta, Catalyst 8.12 graphics drivers

GeForce GTX 295
$499
Nvidia
www.nvidia.com
● ● ● ●

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ● ● ◖ 2.5 = ABSOLUTELY AVERAGE | ● ● ● ● ● 5 = ABSOLUTELY PERFECT

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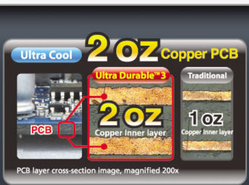

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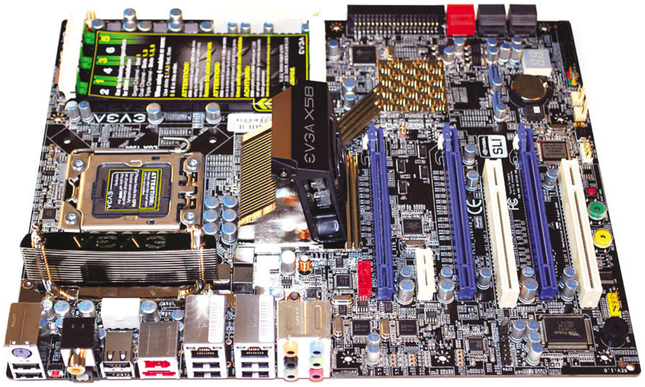
Evga X58 3X SLI



X58 3X SLI
$299.99
Evga
www.evga.com
●●●◖

Specs: Intel X58/ICH10-R, triple-channel DDR3-1600, Slots: 3 PCI-E x16, 1 PCI-E x1, 2 PCI, CrossFireX/SLI support; Ports: 10 3Gbps SATA, 1 eSATA, 2 Gigabit Ethernet, 12 USB 2.0

Since the launch of the new Intel Core i7 processor and X58 Express chipset, a steady stream of X58-based motherboards has been hitting the market from the usual suspects. Of course, Asus, MSI, and Gigabyte stepped up at launch with their offerings, but some of you might not have thought of Evga right out of the gate. Evga is widely known as an Nvidia partner for both graphics cards and motherboards. However, with the official sanction of the Intel X58 Express chipset for SLI support, Evga recently introduced its first Intel-based motherboard offering. In typical Evga fashion, the board's part number is a traditional jumble of cryptic numbers and letters, but the model name is crystal clear to the consumer. The Evga X58 3X SLI motherboard makes no bones about its genetic makeup and target audience of enthusiasts and gamers.

The X58 3X SLI is a nicely equipped design with three full-speed PCI-E x16 slots (Gen 2.0 capable), a single PCI-E x1, and a pair of standard PCI slots. In the lead No. 1 slot position is an eSATA port, as well; we would have preferred Evga put the PCI-E x1 slot there for better accessibility. Across its I/O backplane are a pair of GigE ports, eight USB 2.0 ports (four more internal), SPDIF optical and coaxial audio output ports, eSATA, FireWire, PS2 keyboard, and 8-channel HD Audio ports. The board also supports both AMD ATI CrossFireX graphics, as well as Nvidia 2- and 3-Way SLI configurations. For cooling, Evga employed a modest heatpipe design across the X58 chipset and another taller, stacked-fin heatpipe cooler on its CPU power array. Other design choices included internal power on, reset and clear CMOS, and external clear CMOS (located on the back I/O panel and wonderfully helpful) switches. However, we weren't fond of the location of the 8-pin ATX power connector, which was wedged between the I/O backplane and power array heatsink.

For the overclocker, the X58 3X SLI's BIOS has just about any option you'd want, including multiple voltage and frequency settings for CPU, memory, and chipset, as well as Intel's new QPI serial link for the Core i7 processor. In addition, Evga bundles in its "Eleet" performance tuning software, which supplied a nice control panel interface courtesy of CPUID, developer of the CPU-Z diagnostic package. This private label version of CPU-Z let us adjust clock speeds, multipliers, and voltages, all via the comfort of a very intuitive and familiar interface that we're sure many enthusiasts will recognize and appreciate. On standard air cooling alone, the board mustered a solid 4GHz overclock, up 800MHz from the stock speed of our Core i7-965 Extreme processor.

Benchmark-wise, this Evga board fell in the middle of the pack of X58-based motherboards we tested, besting Intel's own DX58S0 on occasion and trading victories with Gigabyte's GA-EX58 Extreme and Asus' P6T Deluxe.

For a first effort out of the gate with an Intel design, Evga picked a winner with the Core i7 and the X58 Express chipset, and the end result is a motherboard worthy of your consideration. ▲

by Dave Altavilla

Benchmark Numbers

	Evga X58 3X SLI	Gigabyte GA-EX58 Extreme	Intel DX58S0	Asus P6T Deluxe
3DMark 06 (score)				
CPU Test	5584	5523	5652	5810
PCMark Vantage (score)				
Productivity	5603	5464	5695	5583
Communications	5909	5470	6177	6162
Music	5745	5579	6144	6147
Gaming	8312	8715	8777	8835
TV & Movies	4882	4884	5030	5126
Memories	5950	6182	5891	6276
Total PCMarks	6902	5677	7086	6704
Cinebench R10 (score)				
Multithreaded	15580	15250	15680	15841
Lame MT MP3 Encode				
Multithreaded (min:sec)	0:23	0:25	0:25	0:24
Kribibench				
Sponge Model	29.73	27.54	28.17	28.79
Ultra Model	7.35	7.26	28.17	28.79
ET: Quake Wars				
800 x 600, low quality	224.7	203.2	192.5	221.1
Crysis CPU Benchmark				
800 x 600, low quality	202.88	191.55	179.85	199.58

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

Honest Technology Audio Recorder 2.0 Deluxe

Audio Recorder 2.0 Deluxe
$79.99
Honest Technology
www.honestech.com
● ● ● ◖

Specs: Outputs to MP3, WAV, and CD (audio and MP3); Easy Wizard and Advanced modes; ID3 tag and album, artist, and track naming functionality

Although connecting a tape player or turntable to a PC to convert LPs, cassette tapes, and 8-tracks to MP3s has been possible for years, the process required some know-how and elbow grease. The Audio Recorder 2.0 Deluxe, a 2009 CES honoree for design and engineering innovation, pretty much takes brain power and effort out of the equation, as the Audio Recorder is designed so *anyone* can create digital files from analog sources that are suitable for iPods and other portable players. Just know the extreme ease of use comes at the loss of extended file format support and advanced functions.

Setup only requires connecting one end of a supplied RCA cable to the Audio Recorder's MuzBox, an impish RCA-to-USB converter, and the other end to a turntable, cassette player, etc. (I used Pioneer-made gear.) An included USB cable connects the MuzBox to a PC. Next, start the Audio Recorder software in Easy Wizard mode (pictorials included), run a volume level test to ward off distortion, set a Noise Reduction Level (-15 to +15) to prevent hissing, configure an output folder, and name the recording. Click Record, and a blue LED on the converter shows you're in business. Beyond automatically splitting recordings into multiple tracks, the software supports adding ID3 tags for album, artist, and song titles; stopping recordings after designated intervals (otherwise, you must manually stop recordings); and outputting to MP3 and WAV files or burning straight to audio or MP3 CDs (64 to 224Kbps). A limited Advanced mode adds manual track splitting and noise reduction, volume normalizing, and amplification tools.

Although audiophiles might let out a collective hiss upon hearing the MP3 tracks I created from Van Morrison's "Astral Weeks" on cassette and Led Zeppelin's "Houses Of The Holy" on album, these and the roughly 50 others I created are certainly worthy of sticking on DAP. Further, considering the money saved, the files stand alongside MP3s from Amazon MP3 and other download services. ▲

by Blaine Flamig

Logitech Illuminated Keyboard

Illuminated Keyboard
$79.99
Logitech
www.logitech.com
● ● ●

Specs: 9.3mm thick; backlit keys; 12 programmable hotkeys; PerfectStroke key system

The backlit keyboard might be the most prominent feature of Logitech's Illuminated Keyboard, but it's only one of the useful characteristics this keyboard offers.

First, it's a sharp-looking keyboard. Its trendy, slender design makes it much more fun to use than bigger, clunky-looking keyboards, and it's comfortable to use. Typing on the Illuminated Keyboard feels similar to typing on a notebook, but it's not quite as cramped. The keys have a little bounce to them and are soft—both tactilely and acoustically—thanks to the PerfectStroke key system.

The best part of this keyboard is the availability of 12 programmable F-keys. These keys have designated functions, including one-touch launching of your home Web page, email, Web search engine, IM client, document flip, gadgets, calculator, drive eject, and your default media player. Additionally, there are rewind, pause/play, and fast-forward buttons. You can program the F-keys to perform tasks other than the defaults. Although the Illuminated Keyboard had no issues launching Web sites when my Internet browser defaults were Firefox 3 and IE7, it would not work with Chrome.

The backlight on the keyboard can be useful for working on projects in poorly lit rooms, but note that this is not designed specifically for gaming (even though the backlight feature could be useful in this regard). Additionally, the Illuminated Keyboard is about as expensive as a gaming keyboard, which is something to note if you are on the fence about purchasing this keyboard or a backlit gaming keyboard, such as the similarly priced Microsoft SideWinder X6 Gaming Keyboard ($79.95).

Regardless of whether you are going to use this keyboard for gaming, it's very enjoyable to use with the PerfectStroke key system and the programmable F-keys. ▲

by Tessa Breneman

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ● ● ◖ 2.5 = ABSOLUTELY AVERAGE | ● ● ● ● ● 5 = ABSOLUTELY PERFECT

by Anand Lal Shimpi

Revisiting The Dual-Core vs. Quad-Core Debate

Perspective is one of our most important allies. While we love to talk about the move to quad-core, most of that is simply because it's actually affordable. Intel started with the Core 2 Quad Q6600, bringing four cores down to less than $300. But these days, AMD will sell you four cores for around $150, and Intel will do it for $180. Here's where perspective matters, however: Less than 5% of Intel's desktop CPU shipments are quad-core processors; the rest are all dual- and single-core. So perhaps it's time to revisit the dual vs. quad debate and figure out what makes sense.

I'll start by making the argument for dual-core. There is almost never a situation where I'd recommend going with a higher-clocked single-core CPU over a lower-clocked dual-core processor. To illustrate my point, I need go no further than the Athlon LE-1640; this is a 2.7GHz K8-based design from AMD but only features a single core. The lowest-clocked dual-core K8 design is the Athlon X2 4050e, running at 2.1GHz. In nearly all applications where CPU performance matters, the dual-core X2 is faster than the LE-1640 (this includes 3D games, as pretty much all games these days use at least two threads). Video encoding, image editing, gaming, multitasking, and file compression can all make use of two cores. The single-core processors currently on the market are the Athlon LE and Sempron LE from AMD and the Celeron 4xx series from Intel. The only reason to opt for any of them is price, but while the single-core chips are available for as little as $36, you might as well spend $50 and go dual-core. But, of course, the topic at hand is comparing chips with four cores to those with two.

The quad-core market is still incredibly small, and the frequency gap between dual- and quad-core CPUs at the same price point has grown tremendously. At around $185, you can purchase a 2.4GHz Core 2 Quad Q6600 or a 3.16GHz Core 2 Duo E8500, a 32% increase in clock speed, or 766MHz, but with half the cores.

Anand Lal Shimpi has turned a fledgling personal page on GeoCities.com into one of the world's most visited and trusted PC hardware sites. Anand started his site in 1997 at just 14 years old and has since been featured in USA Today, *CBS' "48 Hours," and* Fortune. *His site—www.anandtech.com—receives more than 55 million page views and is read by more than 2 million readers per month.*

If you encode a lot of video, the conventional wisdom says that the benefits of quad-core will be more than enough to make up for the clock speed differential, and, for the most part, that's true in the Q6600 vs. E8500 comparison. The lighter encode tests will actually show the Q6600 and E8500 as equals, but if you're doing Blu-ray backups using x264, then the quad-core is faster, despite its lower clock speed. If you're just making DivX rips of your DVDs, the two won't be all that different.

As you might expect, 3D rendering is the greatest ally of quad-core chips in this comparison; the E8500 just can't hold a candle to the Q6600 in applications like 3ds Max. When the CPU is involved in 3D rendering, having more cores trumps higher clock speeds.

So, what about general, everyday use? For most folks, dual-core will be the way to go here. Even running many applications at the same time, four cores are still difficult to tax unless you have one application that's very thread-heavy (read: 3D rendering). For overall snappiness, you'll have a better time today on a faster dual-core CPU.

Gamers will also appreciate the higher clock speed of a faster dual-core CPU. In nearly all games, the E8500 will stomp the Q6600, although I should point out that "nearly all games" doesn't include Far Cry 2. FC2 is one of the first games I've seen to really benefit from more than two cores, and here the E8500 actually comes in a little slower than the Q6600. If you're buying for the long-term, quad-core may make more sense for gamers, but if you're buying for the next 12 months or so, dual-core is the better gaming bet.

Obviously, if you can afford to get a higher-clocked quad-core CPU, that's going to be your best bet; otherwise don't underestimate your dual-core options: In many cases, they may be your best bet. ▲

Talk back to Anand at anand@cpumag.com

PC Modder

Tips & Tutorials

Modding does the body good. A PC's body anyway, inside and out. Here you'll find hardware, firmware, tools, tips, and tutorials for modding your rig's performance and appearance. Send us your own mod-related tips and ideas at modding@cpumag.com.

Modding enthusiasts have a penchant for the latest toys. Fast processors, powerful video cards, silent SFF enclosures, and radically lit motherboards are all fair game when it comes to a modder's creative mind. Recognizing the appeal of unconventional customization, an entire industry has emerged to support the community.

Mods & Ends

Thermaltake Spedo Advanced Package

Thermaltake recently bolstered its lineup of high-end chassis with the Spedo Advanced Package ($249.99; www.thermaltake.com). Boasting a full-tower design, the Spedo Advanced Package includes a mesh front panel, integrated cable management tools, and a host of cooling fans. The chassis can accommodate seven 5.25-inch and six 3.5-inch drives, respectively, and has eight expansion slot locations and cutouts for liquid-cooling systems. In its stock configuration, the Spedo Advanced includes a 140mm front intake fan, two 120mm rear exhaust fans, a huge 230mm top-mounted exhaust fan, and another 230mm side-panel fan that features a "wireless" connector that doesn't hinder the removal of the side panel itself. Another fan mount is situated on an adjustable bar, so it can be positioned anywhere the user desires. Fans mounted behind the CPU and at the bottom of the case bring the Spedo's potential fan total to eight.

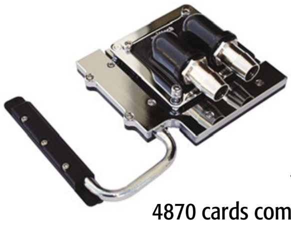
The Thermaltake Spedo also features a tool-less design and a movable hard drive cage that can be mounted at either the bottom or top of the chassis. This case's handy features, cooling performance, and aggressive styling are sure to make it stand out.

Thermaltake's new series of Spedo chassis features tool-free designs, an adjustable fan bar, and built-in cable management tools.

Swiftech MCW60-4870

Swiftech's new MCW60-4870 waterblock is an ideal setup for liquid cooling those hot-running ATI Radeon HD 4870s. What makes the MCW60-4870 waterblock ($89.95; www.swiftech.com) somewhat special is the addition of a secondary heat plate that's attached to the waterblock via a heatpipe. The secondary heat plate is designed to mate with the graphics card's power regulation circuitry to help keep it cool. (Most other GPU waterblocks are designed to cool the graphics processor alone, and additional heatsinks are necessary for the card's VRM.)

The Swiftech MCW60-4870 waterblock offers the same performance and flow rate as the company's popular MCW60 revision 2, and they share the same rigid backplate mounting hardware, as well. As is typically the case with Swiftech's high-end waterblocks, the MCW60-4870 also features a chrome-plated copper base with a slick mirror finish. To round out the package, Swiftech includes 1/2-inch chrome-plated brass hose barbs, 3/8-inch black nylon hose barbs, clamps, mounting hardware, and Arctic Céramique thermal compound.



The Swiftech MCW60-4870 waterblock for Radeon HD 4870 cards combines heatpipe and liquid cooling in a single package.

Aerocool AVN-1000

Looking to quiet down and cool a hard drive? Aerocool may have the answer. Its AVN-1000 hard drive cooler ($34.99; www.xoxide.com) mounts in any available 5.25-inch bay and aids in cooling the drive with an all-aluminum casing and long heatsink fins. To aid in heat transfer from the drive to the casing (and to dampen unwanted vibration and noise), the AVN-1000 features a large, sponge-like thermal pad within the enclosure. When a hard drive is sealed inside, the pad muffles noise and wicks heat away to the aluminum casing.

The AVN-1000 is compatible with any standard 3.5-inch SATA or IDE hard drive, and both black and silver front panels are included.

Fashionably Fresh Firmware

Lite-On DH-4B1S (v7P5B)

A firmware update for the Lite-On DH-4B1S internal SATA Blu-ray/DVD burner adds support for more types of recordable media.

www.liteonit.com

MacBook Pro EFI Firmware Update (v1.6)

Apple has released an EFI firmware update for the new MacBook Pro that fixes several problems that result in improving the stability of the system.

support.apple.com

QNAP TS-509 Pro Turbo NAS (v2.1.0 Build 1202)

A firmware update for the QNAP TS-509 Pro Turbo NAS adds a large number of new features and enhancements. There are fixes for anonymous FTP logins and scheduled booting, among others.

www.qnap.com

by Marco Chiappetta

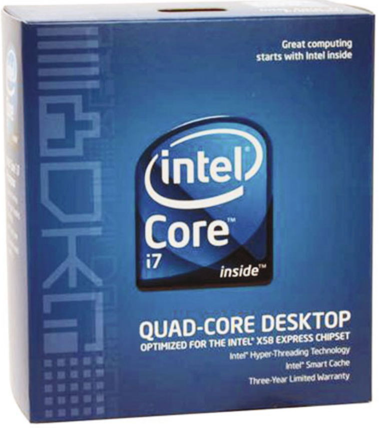
Intel Core i7 920 Overclocking

Push Nehalem To Its Limit

When it launched its Core i7 desktop processors, Intel called it the biggest platform architecture change in the company's history to date. Although the Pentium 4 and Core 2 processors respectively ushered in the NetBurst and Core microarchitectures, neither necessitated an entire platform shift like Core i7 did. With the Nehalem microarchitecture, on which the Core i7 is based, new features and functionality inherent in the design required Intel to essentially revamp its entire desktop platform.

Along with the Core i7 line of processors came motherboards built around a new chipset, the X58 Express, with a new 1,366-pin socket. Because Intel incorporated triple-channel DDR3 memory and specialized power management controllers into the Core i7's die and outfitted the processors with a new cache structure and reworked HyperThreading engine, the chips needed more power and data paths than the trusty Socket LGA 775 could provide. And because Core i7 processors no longer had to interface with a separate memory controller hub in a Northbridge chip, the FSB was axed in favor of a new serial interface, dubbed QPI (Quick Path Interconnect).

All of the changes brought forth by the Core i7 meant overclockers have had a host of fresh intricacies to become familiar with if they wanted to wring the most performance from the new platform. Although there are a plethora of new terms to digest with the Core i7, thankfully it turns out tweaking and overclocking Intel's new baby is fairly straightforward. It also turns out that the Core i7 has plenty of headroom left, even at this early stage of its lifecycle.


Great computing starts with Intel inside
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Core
i7
inside
QUAD-CORE DESKTOP
OPTIMIZED FOR THE INTEL X58 EXPRESS CHIPSET
Intel Hyper-Threading Technology
Intel Smart Cache
Three-Year Limited Warranty

The 2.66GHz Core i7 920 is currently the least expensive model available in Intel's Core i7 desktop processor lineup. At about $300 online, it's approximately $700 cheaper than the flagship Core i7 965 Extreme.

Overclocking Considerations

To show you just what the new Core i7 is capable of, we decided to put Intel's "entry-level" Core i7 processor, the 920, through the wringer and overclock it as far as we could. Although the Core i7 920 is the least expensive processor in the Core i7 lineup, at about $300, it's still somewhat pricey by today's standards. Factor in a good motherboard and triple-channel DDR3 memory kit, and we're talking another $400 to $550, on top of the investment required for the CPU. That's a significant outlay for most of us, so we decided to keep things relatively simple and tweak our Core i7 920 using Intel's stock cooler to illustrate what it could do without investing even more in an exotic, more expensive, cooler.

Before we dig into the specifics, however, there are some special considerations to make when overclocking a Core i7 processor. For one, only the Core i7 965 Extreme is unlocked. That means the Core i7 920 we'll be using (as well as the Core i7 940), must be overclocked through some other means—we'll explain what that is in a little while. Core i7 processors also feature Turbo mode, which increases the CPU's frequency slightly if it's running within acceptable thermal limits. This is important to remember, because Turbo mode may push the ultimate processor frequency too high if you also happen to be overclocking the CPU, so it is best to keep Turbo mode disabled on an overclocked system. Typically, you can disable Turbo mode via the motherboard's BIOS.

Core i7 processors also feature HyperThreading. HyperThreading can boost performance when heavily multitasking or when running multithreaded applications, but it can also make it somewhat harder to overclock. To hit the absolute limit with a Core i7, it helps to disable HT. We think the performance benefits of HyperThreading are worthwhile though, so we left it enabled for this project. We'd gladly sacrifice a few MHz for the addition of four logical processor cores.

Voltage (or, more specifically, memory voltage) is also a consideration when overclocking the Core i7. Intel recommends a memory voltage no higher than 1.65V to prevent damage to the CPU's integrated memory controller. Higher voltages are an option (and we personally haven't killed a Core i7 yet using memory voltages as high as 1.8V), but if Intel recommends staying at or below 1.65V, there is a good reason. To prevent unnecessary damage, we'd recommend using a memory kit specifically designed for the

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Core i7 and capable of high frequencies without needing more than 1.65V.

Finally, there is the BCLK (base clock) to consider. The ultimate frequency of a Core i7 processor, its QPI link, and its memory speed are all derived from a BCLK frequency, which is set to 133MHz by default. Although the FSB is no more, it may help to think of the BCLK frequency as similar to the FSB clock. Raising the BCLK raises the CPU clock, QPI speed, and memory speed in

Intel Core i7 920 Performance: Before & After The Mod

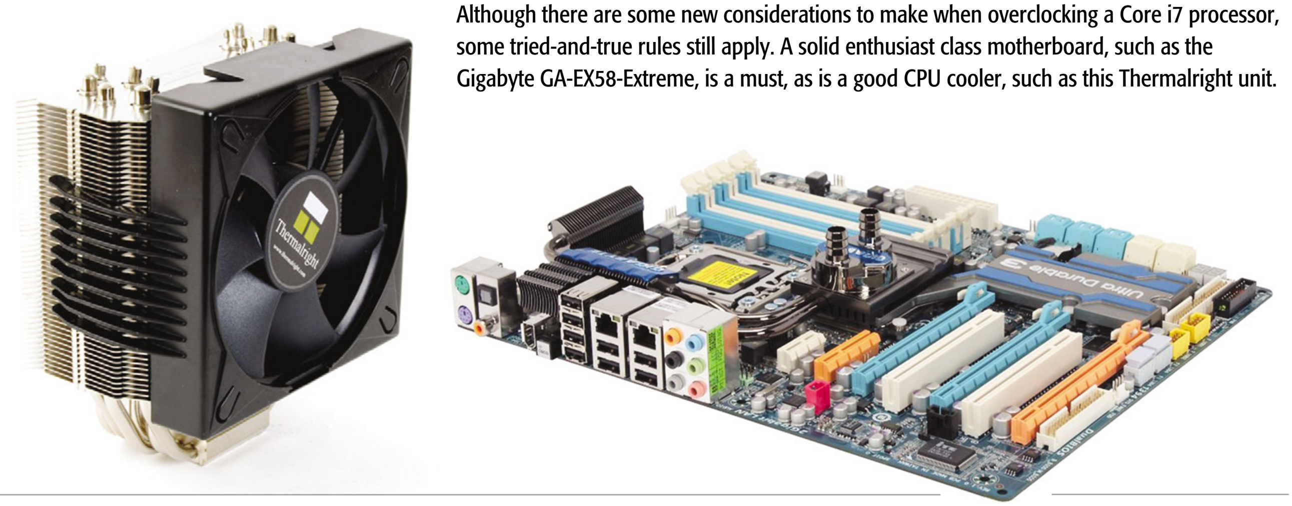
There's no point in overclocking a system and potentially voiding a slew of warranties in the process if there's no reward for the effort. To illustrate just how rewarding it was to overclock our Core i7 920 processor, we ran a handful of benchmarks on our test machine with the CPU running in its stock form and while overclocked. For reference and comparison, we also ran a Core i7 965 Extreme processor through the same battery of benchmarks and compared all of the results in the chart seen here.

The common components in our test system consisted of a GeForce GTX 280 graphics card, Gigabyte GA-EX58-Extreme motherboard, Western Digital 150GB Raptor hard drive, Ultra 1kW PSU, Lite-On DVD-RW drive, and a 3GB triple-channel Qimonda DDR3-1066 memory kit. We ran Windows Vista Ultimate (32-bit) on the system, with Intel's latest chipset software and Nvidia's latest video drivers installed.

As the benchmark results show, there was quite a large performance delta that separated the stock Core i7 920 and the 965 Extreme. In every single test, the Core i7 965 Extreme outperformed the stock Core i7 920 by a sizable margin. With our Core i7 920 processor overclocked from 2.66GHz to 3.8GHz, however, the tables were completely turned. Our modded and overclocked system outpaced the Core i7 965 Extreme by margins ranging from 4.66% to as high at 15.63%. We attained the largest gains in more CPU-intensive applications, such as 3D rendering and the synthetic benchmarks; gaming and encoding tests showed the smallest gains.

	Stock Clock Speeds Core i7 920 @ 2.66GHz	**Overclocked Speeds Core i7 920 @ 3.8GHz**	**Core i7 965 Extreme @ 3.2GHz**	**Percent Difference (Mod vs. Core i7 965 Extreme)**
BCLK Frequency	133MHz	190MHz	133MHz	
Memory Frequency	1,066MHz	1,140MHz	1,066MHz	
SiSoft SANDRA 2009 SP2 **Processor Arithmetic**				
Dhrystone iSSE4.2	70.47 GIPS	97.56 GIPS	84.88 GIPS	14.9%
Whetstone iSSE3	63.87GFLOPS	82.87GFLOPS	74.61GFLOPS	11.07%
Processor Multimedia				
Integer x8 iSSE4.1	126.40 Mpixels/s	169.74 Mpixels/s	148.84 Mpixels/s	14.04%
Floating Point x4 iSSE2	102.25 Mpixels/s	136.41 Mpixels/s	120.23 Mpixels/s	13.45%
Memory Bandwidth (GBps)				
Integer Buffered iSSE2	17.43GBps	19.67GBps	18.32GBps	7.36%
Floating Point Buffered iSSE2	17.41GBps	19.66GBps	18.33GBps	7.25%
Futuremark 3DMark06				
CPU Benchmark	4895	6187	5562	11.24%
LAME MT MP3 Encoding (minutes:seconds)				
Multithreaded	0:29	0:22	0:25	12%
Cinebench R10				
Multithreaded	3,248	4,551	3,902	15.63%
Kribibench v1.1 (FPS)				
Sponge Explode Model	22.99	30.41	28.17	7.95%
Ultra Model	6.17	8.16	7.28	12.10%
POV-Ray (PPS)				
Multithreaded	3,501	4,993	4,340	15.04%
Crysis v1.21 (FPS)				
CPU Test (800 x 600, low quality)	164.57	188.24	179.85	4.66%

(Intel Chipset Drivers v9.1.0.1007; Nvidia ForceWare v180.48)



Although there are some new considerations to make when overclocking a Core i7 processor, some tried-and-true rules still apply. A solid enthusiast class motherboard, such as the Gigabyte GA-EX58-Extreme, is a must, as is a good CPU cooler, such as this Thermalright unit.

lockstep. To keep all things running within stable limits, most X58-based motherboards for the Core i7 give users the ability to alter QPI and memory multipliers independently of the CPU, QPI, and memory clocks. All can be fine-tuned to some degree. Raising the base clock is how we overclocked our Core i7 920.

Tools Of The Trade

We began our Core i7 920 overclocking project by assembling our system in an open-air test bench to ensure excellent cooling. The main parts consisted of a Core i7 920, Gigabyte GA-EX58-Extreme motherboard, and a triple-channel Qimonda DDR3-1066 memory kit. As is always the case when overclocking, adequate cooling and high-quality components are a must. Because we wanted to focus on the CPU frequency for the purposes of this article, we went with Gigabyte's flagship X58 Express-based motherboard, which is an excellent overclocker, but stuck with an affordable memory kit. For a higher memory overclock, a more expensive DDR3-1333 or 1600 triple-channel kit would be a better choice.

Making The Mods

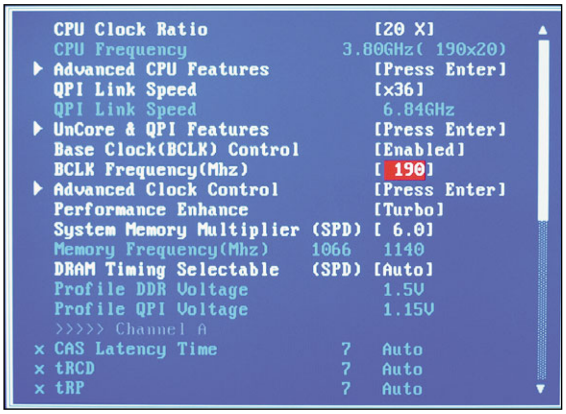
All of the modifications that were necessary to overclock our Core i7 920 processor were made from within the system BIOS. We began by disabling Turbo mode and increasing a few key voltages. As we mentioned earlier, Core i7 processors are sensitive to memory voltage, so we only kicked that up to 1.66V. We weren't planning to push the memory too far, so increasing the memory voltage further wasn't necessary. Then we raised the CPU core voltage up from its default of 1.25V to 1.35V and gave the QPI voltage a slight bump from 1.15 to 1.18V.

Next, we began to increase the BCLK frequency in 10MHz increments until the system was no longer stable. Throughout the process, we also lowered the memory frequency to keep it running as close to 1,066MHz as possible. We were able to boot into Windows with a BCLK frequency of 193MHz, which resulted in a 3.86GHz CPU clock (20 x 193MHz), but the system wasn't completely stable. It would boot into Windows, but some benchmarks, such as Cinebench, would crash to the Desktop. So, we slowly began lowering the base clock and ultimately settled on a BCLK of 190MHz, producing an even 3.8GHz CPU clock. At these speeds, our memory was running at 1,140MHz, and the QPI frequency was at 6.8GTps.

The Final Countdown

A final clock speed of 3.8GHz was an increase of approximately 1.1GHz over the Core i7 920 processor's default frequency and well above the Core i7 965 Extreme's default clock of 3.2GHz. That is an excellent overclock for a brand new CPU using a stock cooler. Keep in mind, as the Core i7 matures, higher clock speeds may be possible; a more powerful cooler would have likely improved our immediate results, as well. Of course, there's no guarantee that every Core i7 920 processor will overclock as well as ours, but early indicators show a lot of promise. With that said, 3.2 to 3.4GHz should be a very real possibility for most chips, which would put this $300 CPU on par with Intel's best. ▲

by Marco Chiappetta



```
  CPU Clock Ratio                  [20 X]
  CPU Frequency                 3.80GHz( 190x20)
▶ Advanced CPU Features            [Press Enter]
  QPI Link Speed                   [x36]
  QPI Link Speed                    6.84GHz
▶ UnCore & QPI Features            [Press Enter]
  Base Clock(BCLK) Control         [Enabled]
  BCLK Frequency(Mhz)              [ 190]
▶ Advanced Clock Control           [Press Enter]
  Performance Enhance              [Turbo]
  System Memory Multiplier (SPD)   [ 6.0]
  Memory Frequency(Mhz)     1066    1140
  DRAM Timing Selectable    (SPD)  [Auto]
  Profile DDR Voltage               1.5V
  Profile QPI Voltage               1.15V
  >>>>> Channel A
x CAS Latency Time             7    Auto
x tRCD                         7    Auto
x tRP                          7    Auto
```

We overclocked our Core i7 920 processor by altering a few options in our motherboard's system BIOS. To achieve our final processor frequency of 3.8GHz (an increase of 42.5%) we increased the CPU Vcore, QPI, and DRAM voltages, dropped the system memory multiplier, and raised the BCLK (base clock) frequency.

Mad Reader MOD

Green Flame

Modders mod because they like to work with their hands, and there's great satisfaction to be had in creating something beautiful. Tony "Tazz" Day certainly knows how to create an eye-catching PC (he's crafted nine other mods), and Green Flame is definitely a head-turner.

Day built Green Flame as his main system, and also as a showpiece for Modders-Inc.com, a modding Web site that he co-owns. This build is based on an eXo Gaming PC case from Ultra Products, and as you can see, Day put a lot of work into modding this case.

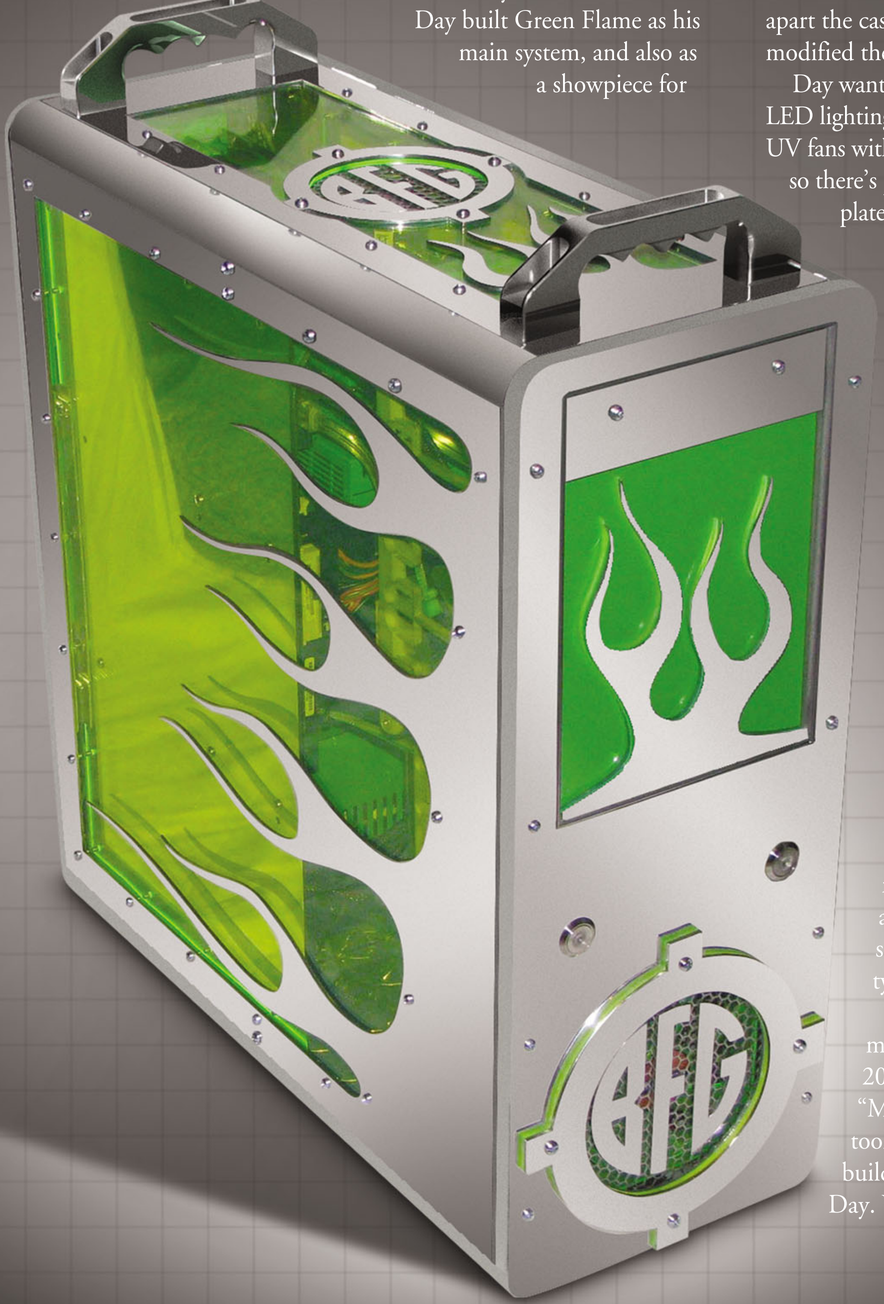
One of the first things Day did to Green Flame was to convert it from an ATX layout to a BTX setup, which he did by taking apart the case frame and swapping around some parts. He also modified the side panels so that they would be easier to remove.

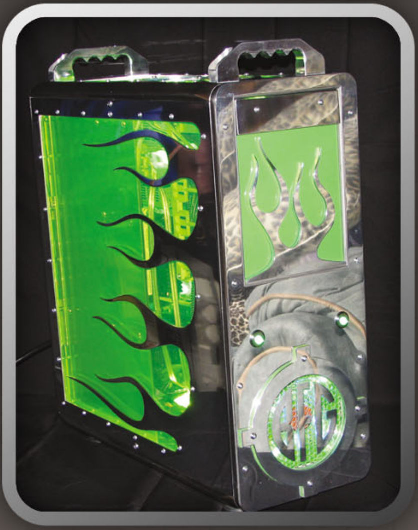
Day wanted a well-lit case, and he decided to go strictly with LED lighting. He installed several LED light strips and a few green UV fans with LEDs built in. The case has a grand total of 92 LEDs, so there's plenty of internal lighting. He also created a switch plate with five switches to control the lights, as well as the power and reset switches. The switch plate is located on the back of the system. Another cool feature Day added was a hard drive activity meter that lights up in the flame on the front of the PC.

The first thing most people notice when looking at Green Flame is the metal flames carved into the case. Day used 1/8-inch 6061 aluminum for the case panels, and he cut the flames using a 16-inch scroll saw and a Dremel. He also hand-cut the BFG fan grilles, which mirror BFG's logo perfectly. The fan grilles were a difficult project; Day says his fingers hurt for days when they were finished. Day hand-sanded and polished the case panels until they gleamed. He finished the mod with a pair of MNPCTech case handles and case feet, which are also brightly polished.

Day didn't skimp on the hardware that powers this PC. The system runs on an Asus P5N-T Deluxe mobo with an Intel E8400 CPU running at 3.8GHz. Green Flame also has a generous 8GB of OCZ Reaper memory, two 250GB Western Digital SATA drives, and an Ultra X3 1,000W PSU. Green Flame also sports a pair of 9800 GX2 video cards, which look pretty hot inside this system.

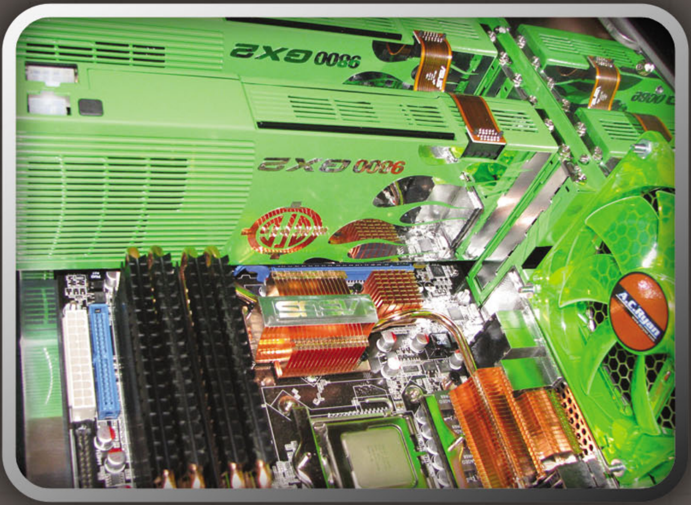
Day tells us that Green Flame took about three months to complete, and that includes several 16- to 20-hour sessions, but the hard work was worth it. "Modding isn't about having endless funds or expensive tools—although they do help. It's about designing and building something that you're passionate about," says Day. We agree. ▲





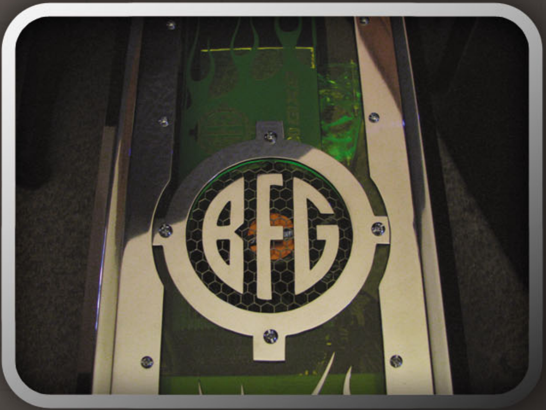
92 LEDs placed throughout the inside of the case add plenty of light to Green Flame.

Green Flame's lighting is controlled by a five-way switch on the back of the system.



Day popped two GX2 9800 video cards into his system and even added flames to the cards to match the Green Flame theme.

The BFG fan covers were difficult to cut but were well worth the effort.



No laser or water-jet cutting here. Day cut these flames into 1/8-inch thick aluminum using a scroll saw and a Dremel.

Give Us Your Mod

Have a computer mod that will bring tears to our eyes? Email photos and a description to madreadermod@cpumag.com. We're looking for rigs that are recognizable as PCs; your Wookiee mod won't find a home here. If we include your system in our "Mad Reader Mod" section, we'll help you load up your modder's toolbox with $1,500 and a one-year subscription to *CPU*.

advanced Q&A corner

Get informed answers to your advanced technical questions from *CPU*. Send your questions, along with a phone and/or fax number so we can call you if necessary, to q&a@cpumag.com. Please include all pertinent system information.

> “The fact of the matter is, yes, workstation graphics cards are loosely based on the same GPU as their consumer-level cousins for the mainstream.”

Each month we dig deep into the mailbag here at CPU *in an effort to answer your most pressing technical questions. Want some advice on your next purchase or upgrade? Have a ghost in your machine? Are BSODs making your life miserable?* CPU*’s “Advanced Q&A Corner” is here for you.*

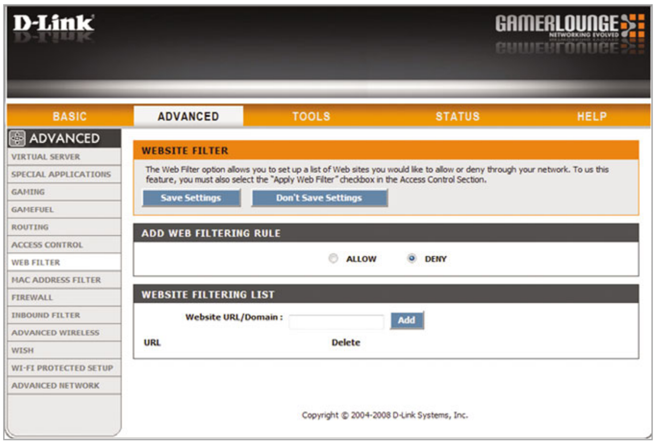
Tom T asks: In addition to reading *CPU*, I also frequent many of the tech hardware sites on the ’Net, and one of my favorites is HotHardware.com (not trying to butter you guys up, honest). I recently read your article on the Nvidia QuadroFX 4800 workstation graphics card and my jaw almost fell to the floor when I saw its price tag of $1999. What is up with that? It’s based on the same GPU as the GeForce GTX 260, isn’t it?

Nvidia’s QuadroFX 4800 Workstation Graphics card, though based on a GT200 series GPU that is similar to Nvidia’s consumer graphics cards, has an MSRP of $1999. But it’s not the hardware that cranks up the price tag, it’s the support and validation of all the various workstation professional design and rendering applications on the market.

A: This is a question we get often when we cover workstation graphics products. The fact of the matter is, yes, workstation graphics cards are loosely based on the same GPU as their consumer-level cousins for the mainstream. However, there are typically subtle changes made in the hardware to support certain types of rendering processes better for the workstation professional. In addition, there is a boatload of software validation that goes into supporting the various types of 3D rendering, mechanical design, and visualization tools like 3D Studio Max, Maya, Catia, and countless others. It’s more the drivers and software tools support that you’re paying for with a workstation graphics solution, not so much the GPU itself. The QuadroFX 4800, though, does come with a beefy 1.5GB of frame buffer memory.

Greg V. asked: I had something terrifying happen the other day and I need some help. I walked into our den and found my 11-year-old son in front of the PC with what was probably about a dozen pornographic Web sites opened. I immediately shut down the machine, and asked him what he was doing, and he said he was just trying to go to some of his favorite sites when all of these pop-ups just started to appear. I did a scan on may machine and couldn’t find any viruses, and I have never had a random pop-up problem myself. The computer is brand new and I keep Windows and the antivirus software up-to-date, so I thought my son was lying at first. But then I noticed in our browser history that he had spelled one of his URLs incorrectly, and when I hit the misspelled link, the same dirty pop-ups flew open.

After this experience, I realized that I absolutely need to restrict my son's Internet access and install some kind of security program on the PC to prevent this from happening again. Can you provide some assistance? I don't have a lot of money to spend, but I want to make sure my son is shielded from this kind of garbage when online.



WEBSITE FILTER

The Web Filter option allows you to set up a list of Web sites you would like to allow or deny through your network. To us this feature, you must also select the "Apply Web Filter" checkbox in the Access Control Section.

ADD WEB FILTERING RULE

○ ALLOW ● DENY

WEBSITE FILTERING LIST

Website URL/Domain :

URL Delete

Most broadband routers have built-in Web filtering tools that give users the ability to limit Internet access for a group of machines or users on the network.

A: We feel your pain, Greg. This is something we know a lot of parents struggle with. We all want to give our kids access to the excellent tools and information available online, to help them with schoolwork or entertain themselves, but there is definitely some dangerous content on the Web that children shouldn't see.

You didn't mention what operating system is installed on your machine, but because it's new, we suspect you have Windows Vista installed. If that's the case, you already have some parental control software installed on the system that you can take advantage of. Click the Vista orb, type Parental Controls in the search field, and press Enter (or go to the control panel and select User Accounts and then Family Safety). A window will then open up in which you can configure Web restrictions and time limits, or allow or block specific programs. To use Vista's built-in parental controls, you'll have to create a restricted user account for your son to use, if you haven't done so already. Then you can restrict that account from accessing certain Web pages, such as pages with adult content. You can also restrict what times he can access the PC and the Web.

If you don't have Windows Vista, you're not out of luck. Most broadband routers also have some Web filtering and access restriction tools built in. If you have a router, you can likely use it to block certain Web sites from your son, as well. Usually, you can log in to a router through your Web browser and configure its Web filtering tools from the advanced networking menu. Consult your user's manual or the router manufacturer's support Web site for specific instructions. If you do end up having to purchase parental control software though, it's not terribly expensive. You can find programs such as Net Nanny or Cyber Patrol available for about $40 to $50 for a yearly subscription.

Johnny I. asked: I am getting an annoying error every time I try to run a Microsoft Office 2003 application, such as Word or Excel. Whenever I try to open one of the apps, an error message immediately pops up that says that Office needs to install some files and I am asked to insert the installation CD. I guess that's not a problem for most people, but my computer didn't come with an original Office CD. The weird thing is, all of these programs used to work perfectly fine and it's just now, all of a sudden, that I'm being asked to insert the installation CD for some reason. What do you think happened? Do I have to go out and buy another copy of Office even though it came installed on my system, or is there a way to get around this error message?

A: It sounds like an Office update may have been installed which requires a file that wasn't copied to your system during the initial installation, or perhaps there has been some sort of corruption of your Office installation and the CD is needed to repair it. Before you do anything else, perform a disk cleanup and scan your hard drive for errors just to ensure there aren't any orphaned or corrupt files, or bad sectors on the drive. If there are, it could be an indication of a larger problem, like a failing hard drive, so back up any important data on the drive as soon as possible.

After you've checked your drive for errors and backed up any important files, there is something you could try before procuring an Office CD. First, look at the root of all of the drives in your system for a folder labeled MSOCache. When Office 2003 (or 2007) is initially installed on a system, it will create a hidden folder on the root of the drive with the most available disk space by default, in which all of the local install files are copied. By doing so, users do not have to insert the original Office CD to add an Office component, to perform a repair of the Office installation, or to install some Office updates. If the MSOCache folder is still on your drive, you can point the program there instead of inserting the CD when you get the error message. If you don't see the MSOCache folder on your drive(s), go to the folder options control panel, click the View tab, and select the option to Show Hidden Files And Folders. If you still don't see the folder, it's possible that it was deleted, at which point you'd need an original Office CD.

Before you purchase a copy of Office, though, keep in mind you can use any Office 2003 CD to repair the problem; it doesn't have to be the exact same CD that was used to perform your initial installation. If your copy of Office is legit and you just weren't given hard copies (or didn't create them) when you purchased the machine, there's no reason to spend any money to resolve this problem. ▲

by Dave Altavilla and Marco Chiappetta,
the experts over at HotHardware.com

For bonus content, subscribers can go to
www.cpumag.com/cpumar09/q&a

Hackers Trying To Say 'Gotcha' To CAPTCHA

Reports of the imminent demise of CAPTCHA systems apparently are greatly exaggerated.

Still, the attacks on CAPTCHAs continue in earnest, and one of the developers of CAPTCHAs says it's probably only a matter of time until the attacks make all text CAPTCHA technology obsolete.

CAPTCHAs are the visual puzzles some Web sites use to try to ensure a human is accessing the site. The puzzles try to prevent computers from accessing a site to try to distribute spam. (CAPTCHA is short—very short—for Completely Automated Public Turing test to tell Computers and Humans Apart.) CAPTCHAs initially appeared in the late 1990s, and most of the puzzles are text CAPTCHAs, involving a string of letters and numbers that are distorted or that appear over the top of a grid or a curved line. By distorting the characters, the CAPTCHA can fool spammers' computers using visual recognition technology to try to solve the CAPTCHA.

Breaking Point

Luis von Ahn, a scientist at Carnegie Mellon University who helped create the reCAPTCHA system (recaptcha.net), says he has seen no evidence of actual computers defeating the best CAPTCHAs.

"The easy ones without much distortion have been broken," von Ahn says. "The ones with more distortion still haven't been broken. . . . We know that [reCAPTCHA] is not broken. We are being attacked, but it's obviously by low-cost human labor. We know this because the mistakes being made are by someone striking a nearby key or by someone transposing letters, mistakes that a computer would not make."

Obviously, as the distortion to the letters increases, the puzzles become more difficult for humans to read and solve, too. If the current trends continue, it would seem obvious that one of two things will happen to CAPTCHAs in the future: The distortion needed to fool computers will become too prohibitive for humans to solve, or computers will fully crack CAPTCHAs, regardless of the distortion used. Once one of those two scenarios occurs, CAPTCHAs will lose their viability.

"I think that will happen," von Ahn says. "I don't know when, but, I think at some point, computers will be as good as humans at reading CAPTCHAs. . . . There's a lot of money out there to try to break CAPTCHAs."

Cracking The Code

One researcher, Jeff Yan of the University of Newcastle in the United Kingdom, has developed a program that solved some CAPTCHAs more than half the time. Yan says he initially solved a CAPTCHA Microsoft was using in September 2007, but he didn't announce his findings until April 2008, giving the company a chance to correct the vulnerability. Yan discovered a similar flaw in a Yahoo! CAPTCHA in April 2008, releasing some details of that problem in October 2008.

"My motivation to look into these CAPTCHAs was that, although CAPTCHA technology had been widely used as almost a standard security mechanism, nobody at the time seriously examined the strength of these mechanisms from a security engineering perspective," Yan says. "At a high level, CAPTCHA is a good idea, but the devil is in the details. It's tricky to strike the

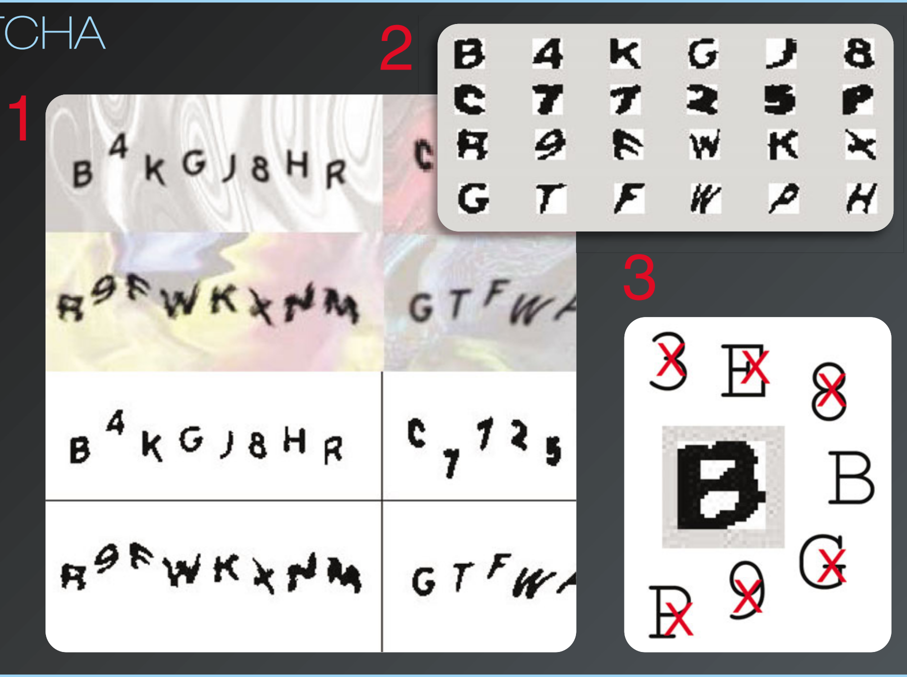
Breaking The CAPTCHA

To defeat text CAPTCHAs, hackers have two options: hire humans to break the CAPTCHAs manually or develop AI programs that can recognize the text. A computer that can break a CAPTCHA must follow three steps to recognize the text.

Preprocessing. In the preprocessing step (1), the computer attempts to separate the characters of the text from the background.

Segmentation. In the segmentation step (2), the computer attempts to isolate each character from the other characters.

Recognition. With the characters isolated, the recognition step (3) attempts to "read" each character. ▲



Source: Network Security Research

right balance between its security and robustness."

Many companies, including Google, Yahoo!, and Microsoft, continue to use CAPTCHAs for various functions, including Web-based email. Google declined to comment for this story.

"There is no company out there that is giving up on them," von Ahn says. "I'm quite engrossed with reCAPTCHA, and it's going really well. A lot of big Web sites use reCAPTCHA. We're under constant attack, but we see no evidence of it being broken at all. . . . I know people dislike the CAPTCHA. But it's wishful thinking" that computers are breaking the reCAPTCHA technology.

Yan says the continued scrutiny of antispam researchers will continue to improve CAPTCHAs.

"More research efforts are needed, and these, including my own ongoing research, will contribute to better CAPTCHA designs," Yan says. "For the near future, I think no matter how much people like or hate it, CAPTCHA will still be around. The reasons are simple. First, it's now part of the Internet infrastructure. Second, it has indeed made, and will continue to make, spammers' lives harder. Third, better CAPTCHA designs will emerge soon." ▲

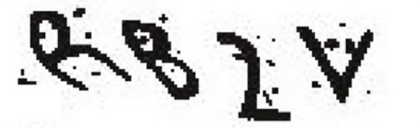
by Kyle Schurman

Problems With Breaking CAPTCHAs

While AI programs can break some text CAPTCHAs, other configurations are more difficult to break. Some of the issues computers have when trying to break CAPTCHAs are listed here. ▲

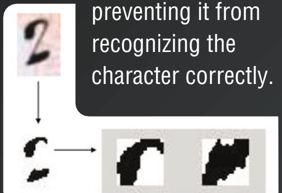
Excessive Noise

If the computer cannot successfully remove the entire background in the preprocessing step, it might leave some characters difficult to decipher.



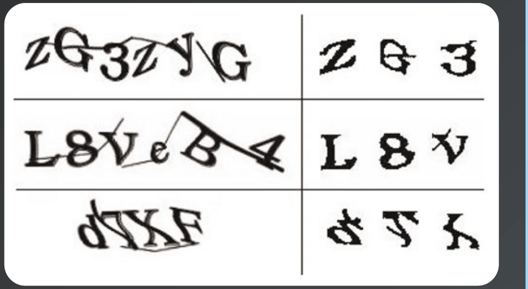
Differing Character Weights

In this example, the AI program loses the thin line of the downward stroke of the "2" in the preprocessing step. Then, in the segmentation step, the computer reads the "2" as two separate segments, preventing it from recognizing the character correctly.



Strong Distortion

Through distortion of characters and running lines of varying weights through the characters, the CAPTCHA can give the AI program problems with removing the lines in the segmentation step and determining the characters in the recognition step. Some distortions are more difficult to decipher than others. As shown here, the bottom row is extremely difficult to decipher correctly for an AI program . . . and, potentially, for humans.



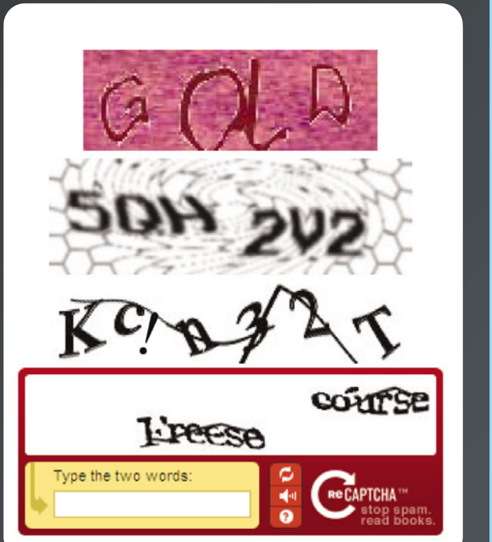
Easy CAPTCHAs

AI programs have better success breaking CAPTCHAs with fonts that are easy to read, with no character distortion, with little to no character rotation, with symmetrical backgrounds, and with no difference in line weights (either in the background or in the character strokes).

Difficult CAPTCHAs

These CAPTCHAs make use of strong distortion of characters, varying line weights, nonsymmetrical backgrounds, nonsymmetrical characters, and symbol characters to make the job of breaking the CAPTCHA difficult. Unfortunately, some of those same factors can make the text CAPTCHA difficult for humans to read and solve, too.

The reCAPTCHA system (bottom example) uses two challenge words and words that it scans from actual books that the system is working to digitize. If an OCR program cannot read the word, it becomes part of the reCAPTCHA system. As users solve those words, they become part of the digitized version of the book, replacing the word that the OCR cannot read, meaning reCAPTCHA serves two purposes.


Type the two words:
reCAPTCHA™
stop spam.
read books.

Sources: PWNtcha, Network Security Research

MOTHERBOARD MOTHER LODE

FIND THE BEST BOARD FOR YOUR BUILD

INTEL BOARDS 64

AMD BOARDS 72

Whether it's the excitement of choosing a platform for a new system or the fulfillment of finding the chipset that takes full advantage of our handpicked components, we enjoy picking out the "right" motherboard. And over the course of 2008, there were a lot of developments in chipsets—improved support for SLI and CrossFireX, increased options for DDR3, and Intel's Nehalem microarchitecture—that added to our motherboard considerations. Before you jump into our buying guide, check out the top engineering wrinkles for motherboards in 2008.

This time last year, AMD was pushing out its 7-Series chipset offerings, which provided support for its triple- and quad-core processors, as well as HyperTransport 3.0. Intel was promoting its X48 chipset that utilized its new 45nm-based processors with 1,600MHz FSB to match DDR3-1600 memory modules. Intel and AMD also launched two elite PC platforms, Skulltrail and Spider, respectively. Intel's Skulltrail (officially titled the Dual Socket Extreme Desktop Platform) provides dual-CPU capability for up to eight processor cores, support for 16GB of DDR2-800 FBDIMM memory, and support for both Nvidia SLI and ATI CrossFireX.

AMD's counter, the Spider platform, lets you to use AMD's OverDrive software with an AMD quad-core Phenom CPU, ATI Radeon HD series GPUs, and AMD 7-Series chipset. Spider provides the potential for up to four video cards or four GPUs on one motherboard.

The greater multi-GPU support delivered significant improvements in gaming performance and other 3D applications. Nvidia introduced support for 3-Way SLI via the nForce 780i SLI platform, which provides three PCI-E x16 slots that run at the full x16 PCI speed, and it built on the 780i with the nForce 790i platform with Quad SLI support (two Nvidia dual-GPU graphics cards). For those with AMD processors, the nForce 780a SLI platform supports 3-Way SLI, while the nForce 750a allows 2-Way SLI.

To match Nvidia's chipset enthusiast-level performance, AMD countered with the 790FX chipset, which supports up to four PCI-E x16 slots (can run two cards at x16 speed or four cards at x8 speed). CrossFireX is also supported on the 790X chipset via its two PCI-E x16 slots. Over the course of 2008, we were frequently

impressed by the benchmark-busting power of single- and dual-GPU cards running SLI or CrossFireX.

The integrated graphics market also saw a big change in 2008. In March, AMD announced its 780G chipset, which featured a Radeon HD 3200 GPU that provides a unified DirectX 10 architecture and support for Shader Model 4.0. When you combine AMD's HD and Blu-ray content-decoding ability with the chipset's HDMI, DVI, and DisplayPort outputs, 780G provides a set of features ideal for HTPCs. Later in 2008, AMD upgraded the 780G chipset to the 790GX chipset, which features a Radeon HD 3300 GPU. Both 780G and 790GX feature Hybrid CrossFireX, so you can combine an integrated GPU with a compatible video card. Similarly, Intel's G45 chipset provides DX10 support using Intel's GMA X4500 HD built-in GPU, and with the G45's Hybrid SLI and PureVideo HD abilities, you have both respectable gaming and HTPC capabilities.

Motherboards were also hit by the "green IT" trend in 2008. Asus introduced its EPU (Energy Processing Unit) that automatically throttles down your system components when not under load; Foxconn added a "Green Series" lineup with GoD (Green on Demand) and GSM (Green System Mode); and Gigabyte integrated its DES (Dynamic Energy Saver) into a number of its popular models. Additionally, Intel's Atom platform helped usher in a new class within netbooks. The Mini-ITX form factor Atom boards include a soldered-on Atom processor, integrated graphics media accelerator, built-in HD audio, and 10/100 Ethernet connectivity.

Last but not least, Intel ended 2008 by announcing its X58 chipset, which corresponded with the release of Intel's Nehalem platform. The X58 chipset boasts a new socket, LGA 1366, and the replacement of FSB with QPI (QuickPath Interconnect). The X58 chipset also supports three DDR3 channels that allow you to use a full 25.5GBps transfer rate.

Now that we've given you plenty to think about for your build, you can use our 2009 buyer's guide to select a model that perfectly suits your needs. It's hard when putting together a list of top motherboards to include every model that's worthy of mention, so we packed as many of the top boards as we had space to hold. ▲

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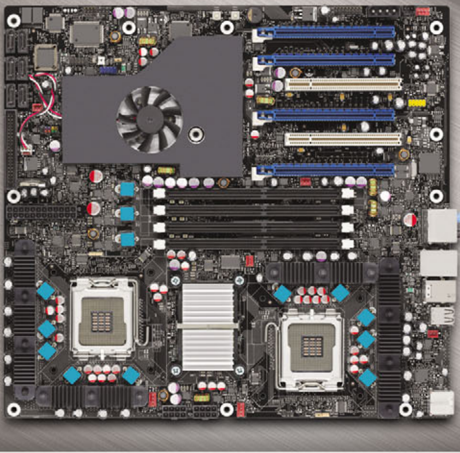
by Nathan Lake



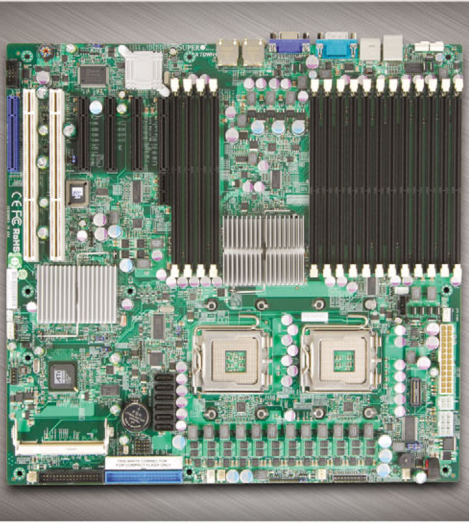
Intel D5400XS

$700 • www.intel.com

Why we dig it: Dual-CPU capability for up to eight processing cores and compatibility with either CrossFireX or SLI. It also has 10 USB 2.0 ports, six SATA (two eSATA ports with RAID support), and an IR receiver.

Who should apply: If you're looking for maximum processing power, Skulltrail is still it. In particular, digital media creators and editors will find the Intel D5400XS provides ideal multitasking power.

Socket type: Intel Socket 771, Intel Core 2 Extreme QX9775 or Xeon processors **Chipset:** Intel 5400 Express **Memory support:** Max memory: 16GB fully buffered DDR2-800, four FB-DIMM slots



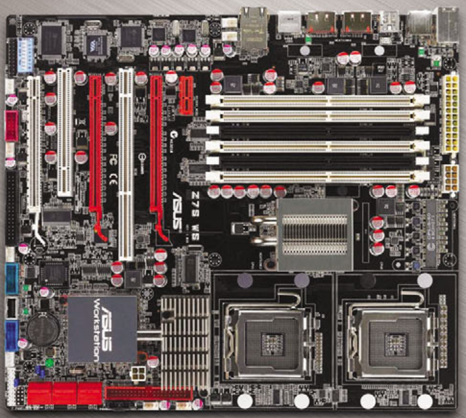
Super Micro X7DWN+

$510 • www.supermicro.com

Why we dig it: This Skulltrail motherboard supports up to 128GB of fully buffered DDR2-800 and includes Super Micro's Super Doctor III Server Monitoring software. It also offers built-in error detection, which can correct single-bit errors and note double-bit errors.

Who should apply: Professionals looking to set up a home server that can handle processor-intensive tasks.

Socket type: Intel Socket 771, Intel Core 2 Extreme QX9775 or Xeon processors **Chipset:** Intel 5400 Express **Memory support**: Max memory: 128GB fully buffered DDR2-800, 16 FB-DIMM slots



Asus 7ZS WS

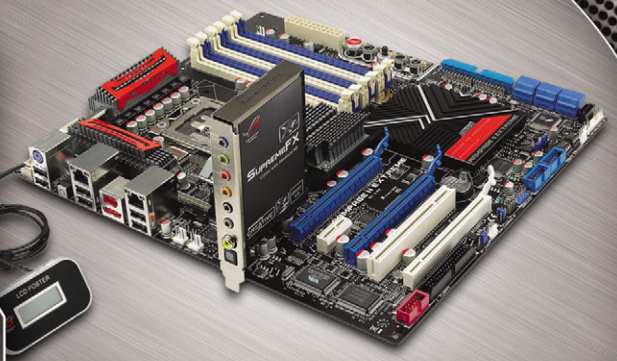
$499.99 • usa.asus.com

Why we dig it: Based on the Intel 5400 chipset, the 7ZS features a CEB (Compact Electronics Bay, standard for dual-processor motherboards) form factor, a built-in digital VRM controller, and support for Q-shield and Q-connectors, which ease board installation. Asus also adds a fan that can automatically adjust to temperature, and the motherboard is rack-ready.

Who should apply: Its CEB form factor provides a compact size (comparable to other workstation motherboards) that's ideal for small workstation setups. The 7ZS WS can also handle server duties.

Socket type: Intel Socket 771, Intel Core 2 Extreme QX9775/Xeon processors **Chipset:** Intel 5400 Express **Memory support:** Max memory: 24GB fully buffered DDR2-800, six FB-DIMM slots

BOARDS



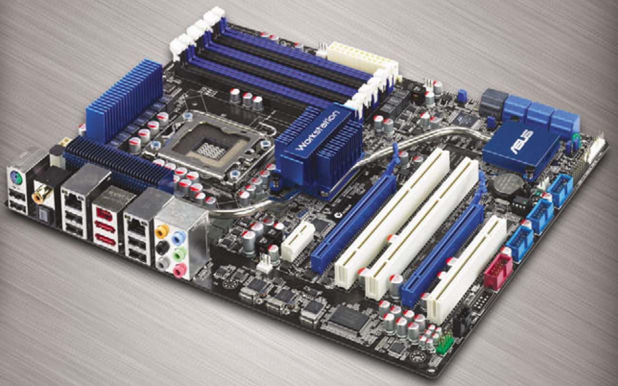
Asus Rampage II Extreme

$399.99 • usa.asus.com

Why we dig it: This Intel X58 chipset motherboard includes Asus' TweakIT and ProbeIt overclocking tools, as well as its multiphase power management system with multilayer polymer capacitors for accurate and stable overclocking control. The board also includes SupremeFX X-Fi HD audio, which features audio designed to help gamers spot enemies and emphasize voices.

Who should apply: If you're looking to maximize the power of your new Core i7 processor, this board has all the tools you'll need. Power users will also appreciate the built-in RAID 0, 1, 5, and 10 support.

Socket type: Intel Socket 1366 Core i7 Processor Extreme Edition or Core i7 CPU **Chipset:** Intel X58 **Memory support:** Max memory: 12GB DDR3-1800, six DIMM slots



Asus P6T WS Revolution

$399.99 • usa.asus.com

Why we dig it: The P6T WS supports either 2-Way SLI or CrossFireX via two PCI-E x16 slots. Additionally, it includes two built-in SAS connectors and PCI-X expansion slots, so you can connect multiple storage options. Asus EPU technology can control the power consumption of your CPU, video card, memory, chipset, hard drives, and system fans.

Who should apply: Builders who want plenty of options when selecting workstation components.

Socket type: Intel Socket 1366 Core i7 Processor Extreme Edition or Core i7 CPU **Chipset:** Intel X58 **Memory support:** Max memory: 12GB DDR3-1333, six DIMM slots

MSI Eclipse SLI

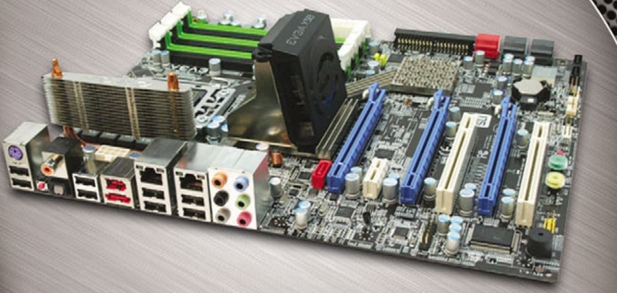
$360 • www.msicomputer.com

Why we dig it: With MSI's Active Phase Switching, DrMOS, and split heatpipes, the Eclipse provides a number of ways for you to lower power consumption, board temperature, and deliver power free of spike noise. We also like that MSI includes a D-LED 2 device that displays potential boot problems for troubleshooting.

Who should apply: Power users jumping to the X58 chipset that want energy efficiency when their PC doesn't require all of the system's power.

Socket type: Intel Socket 1366 Core i7 Processor Extreme Edition or Core i7 CPU **Chipset:** Intel X58 **Memory support:** Max memory: 24GB DDR3-1600, six DIMM slots

SPOTLIGHT



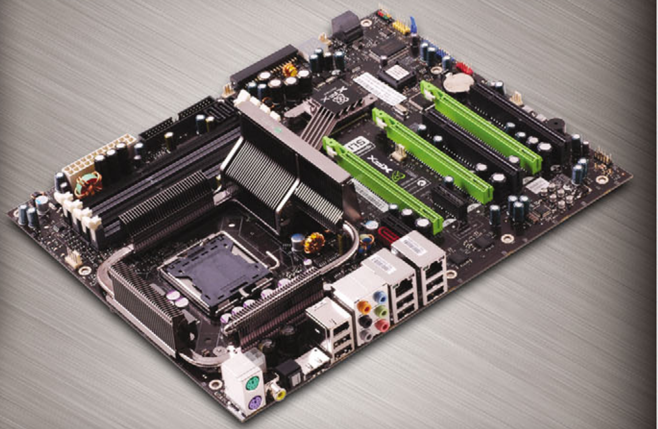
Evga X58 SLI

$350 • www.evga.com

Why we dig it: Evga's VDroop controls provide a variety of voltage controls, and with Evga's Eleet tuning utility software, you can quickly tune the motherboard's components. The Evga X58 SLI board also supports RAID 0, 1, 5, and 0+1 configurations.

Who should apply: Nvidia graphics card owners who want to quickly adjust their system's processor, memory, and graphics card settings.

Socket type: Intel Socket 1366 Core i7 Processor Extreme Edition or Core i7 CPU **Chipset:** Intel X58 **Memory support:** Max memory: 12GB DDR3-1600, six DIMM slots



XFX nForce 790i Ultra

$340 • www.xfxforce.com

Why we dig it: The XFX nForce 790i Ultra supports full 3-Way and Quad SLI, as well as DDR3-2000 memory modules. There's also a built-in POST controller with display and good cooling to move heat away from 3-Way SLI setups.

Who should apply: If you're looking to run 3-Way SLI, you'll certainly want to consider XFX's nForce 790i Ultra.

Socket type: Intel Socket 775, Intel Core 2 Extreme (ideal to match gaming performance of multi-GPU setups) **Chipset:** 790i Ultra SLI **Memory support:** Max memory: 8GB DDR3-2000, four DIMM slots

Evga nForce 790i Ultra SLI

$340 • www.evga.com

Why we dig it: This 3-Way SLI or Quad SLI motherboard features three PCI-E x16 slots that provide the full x16 speed. Of course, this nForce 790i Ultra SLI also comes with Nvidia MediaShield storage and Nvidia FirstPacket technology.

Who should apply: Enthusiasts looking to harness the power of 3-Way SLI with Intel Socket 775 processors.

Socket type: Intel Socket 775, Intel Core 2 Extreme, and Intel Core 2 Quad processors are a good idea. **Chipset:** 790i Ultra SLI **Memory support:** Max memory: 8GB DDR3-2000, four DIMM slots

BOARDS

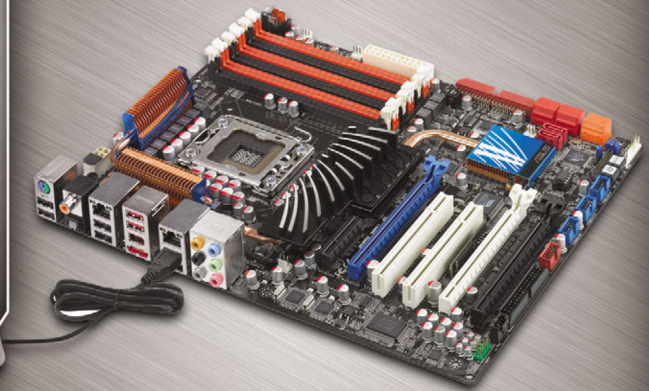
Gigabyte GA-EX58-UD4P

$339 • www.gigabyte.us

Why we dig it: Gigabyte builds in 2 ounces of copper PCB to lower system temperature, improve energy efficiency, and offer greater stability when overclocking. This board also includes a TPM (Trusted Platform Module) chip with 2,048-bit encryption, so you can use the motherboard and an encryption application to protect the data on your computer.

Who should apply: Those looking to jump into the X58 chipset with a motherboard that has the thermal properties to effectively run for a long time. Support for DDR3-2100 offers additional futureproofing.

Socket type: Intel Socket 1366 Core i7 Processor Extreme Edition or Core i7 CPU **Chipset:** Intel X58 **Memory support:** Max memory: 24GB DDR3-2100, six DIMM slots



Asus P6T Deluxe

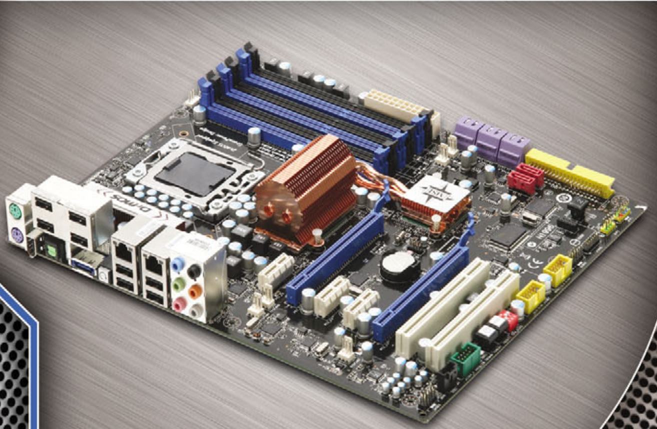
$299.99 • usa.asus.com

Why we dig it: It features arched copper pipes to cool the northbridge, and the orientation of the fins is designed to guide airflow from your CPU fan away from the motherboard.

The 16+2 phase power design also helps lower temperature and noise. There's also Asus' TurboV hardware controller, so you can tab out of a game and adjust OC settings on the fly.

Who should apply: It's ideal for those planning to air-cool a Core i7 processor. Onboard SAS is appealing if you use workstation-level storage.

Socket type: Intel Socket 1366 Core i7 Processor Extreme Edition or Core i7 CPU **Chipset:** Intel X58 **Memory support:** Max memory: 12GB DDR3-1600, six DIMM slots



MSI X58 Platinum

$250 • www.msicomputer.com

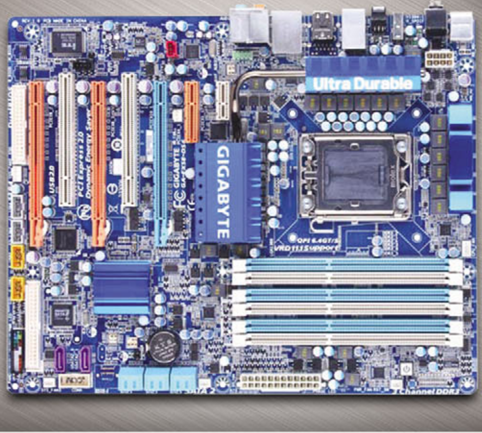
Why we dig it: Designed to support CrossFireX, rather than both SLI and CrossFireX, the X58 Platinum offers an attractive price for an Intel X58-based motherboard. Otherwise, the X58 Platinum offers similar features to MSI's Eclipse SLI board.

Who should apply: ATI Radeon owners who're looking to use their card(s) on Intel's Nehalem platform.

Socket type: Intel Socket 1366 Core i7 Processor Extreme Edition or Core i7 CPU **Chipset:** Intel X58 **Memory support:** Max memory: 24GB DDR3-1600, six DIMM slots

SPOTLIGHT

BOARDS



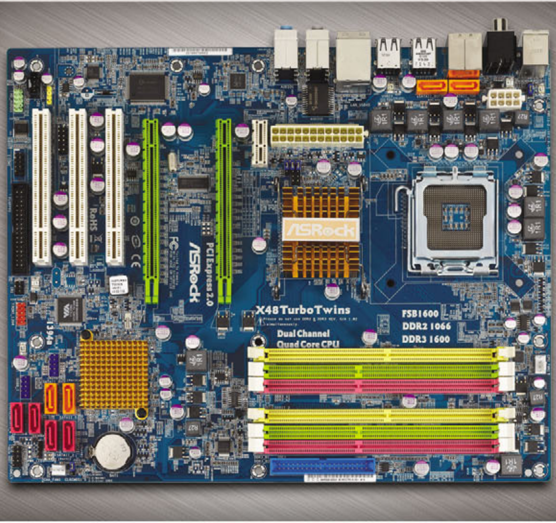
Gigabyte GA-EX58-DS4

$245 • www.gigabyte.us

Why we dig it: This board's hardware overvoltage control lets you manage the voltage of the CPU, northbridge, and memory using 20mV increments for precision settings. And with the memory timing controls, the GA-EX58-DS4 can adjust the memory to match your system voltages.

Who should apply: Overclockers meticulous about their system voltages and timings. The GA-EX58-DS4 also supports CrossFireX.

Socket type: Intel Socket 1366 Core i7 Processor Extreme Edition or Core i7 CPU **Chipset:** Intel X58 **Memory support:** Max memory: 24GB DDR3-2100, six DIMM slots



ASRock X48TurboTwins

$210 • www.asrock.com

Why we dig it: This Intel X48 chipset board includes a built-in ASRock Wi-Fi 802.11g module and antenna. It also features support for CrossFireX via two PCI-E x16 slots, as well as two eSATA and two FireWire ports.

Who should apply: Those who either already own or are looking to purchase an Intel LGA 775 45nm processor and ATI graphics cards. The X48TurboTwins offers an outstanding built-in feature set.

Socket type: Intel Socket 775, Intel Core 2 Extreme or Quad (to take advantage of 1,600MHz FSB) **Chipset:** Intel X48 **Memory support:** 8GB DDR3-1600 or 8GB DDR2-1066, four DDR3 or two DDR2 DIMM slots

Evga nForce 750i SLI FTW

$180 • www.evga.com

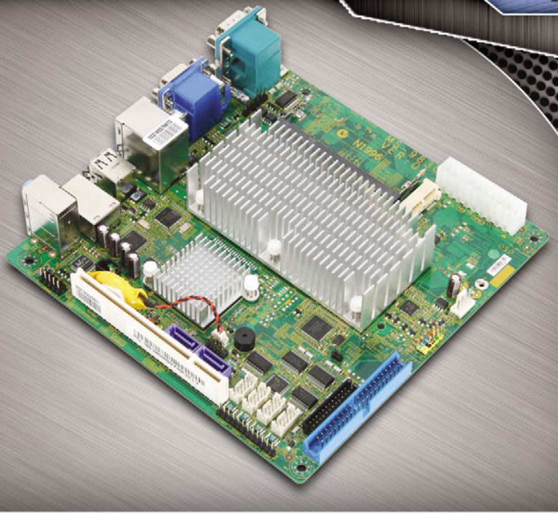
Why we dig it: This FTW edition motherboard features a six-phase power design to provide stable overclocking for both your CPU's FSB and system memory. The nForce 750i SLI FTW also includes support for RAID 0, 1, 0+1, and 5.

Who should apply: Gamers who want to get the most out of their Intel Yorkfield or Wolfdale processor.

Socket type: Intel Socket LGA 775, "Extreme" Intel processors provide more headroom for overclockers **Chipset:** nForce 750i **Memory support:** Max memory: 8GB DDR2-1066, four DIMM slots

SPOTLIGHT

BOARDS



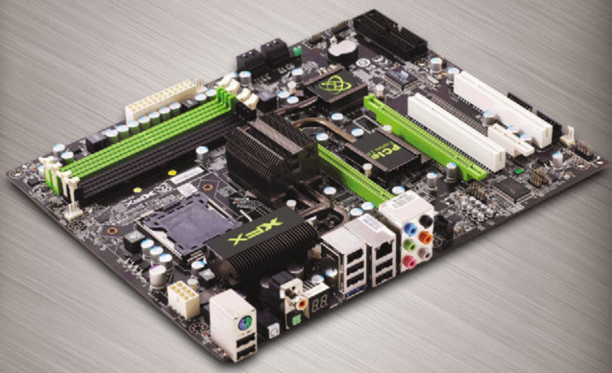
MSI IM-945GSE

$175 • www.msicomputer.com

Why we dig it: This Atom-based board provides a low-power fanless design and an Intel GMA950 integrated GPU that provides support for DirectX 9c and OpenGL 1.4. It also supports dual monitors via its VGA and DVI outputs.

Who should apply: Those building small netbooks or a car PC.

Socket type: Intel Atom N270 **Chipset:** Mobile Intel 945GSE **Memory support:** Max memory: 2GB DDR2-533, one DIMM slot



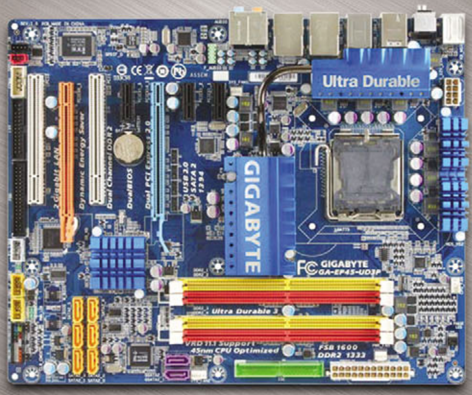
XFX nForce 750i SLI

$170 • www.xfxforce.com

Why we dig it: With support for 2-Way SLI, the XFX 750i SLI provides PCI-E 2.0 support and overclocking tools for Intel Yorkfield and Wolfdale processors. Rear-panel clear CMOS button and a debug LED provide handy quick-fixes for overclockers.

Who should apply: If you have two Nvidia graphics processors and want a board with good integrated overclocking tools, the XFX 750i SLI has what you need.

Socket type: Intel Socket LGA 775, Intel Core 2 Extreme models work well for overclockers. **Chipset:** nForce 750i **Memory support:** Max memory: 8GB DDR2-800, four DIMM slots



GA-EP45-UD3P

$150 • www.gigabyte.us

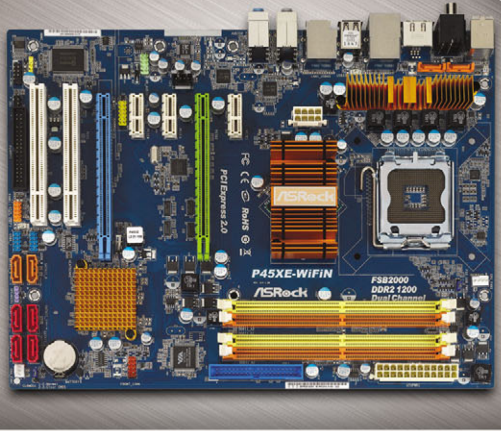
Why we dig it: Gigabyte packed a lot of features into the GA-EP45-UD3P. You have the standard P45 features, such as two PCI-E x16 slots (one at x16 speed, one at x8 speed), as well as Gigabyte's Xpress Recovery2 (compresses and backs up system data), DualBIOS, and Ultra Durable 3 build quality (2 ounces of copper PCB).

Who should apply: If you have an Intel Core 2 processor and DDR2 memory, this board provides all the features you'll need to take advantage of the hardware.

Socket type: Intel Socket LGA 775, 45nm Intel Core 2 Duo/Quad processors **Chipset:** Intel P45 **Memory support:** Max memory: 16GB of DDR2-1333, four DIMM sockets

SPOTLIGHT

BOARDS



ASRock P45XE-WiFiN

$150 • www.asrock.com

Why we dig it: As you might guess, ASRock's P45XE-WiFiN includes an 802.11 Draft N module and antenna. Additionally, this motherboard supports CrossFireX, as well as 7.1 HD audio and RAID setups (0, 1, 5, 10).

Who should apply: Intel Yorkfield or Wolfdale processor users who want a motherboard with built-in 802.11 Draft N and overclocking controls.

Socket Type: Intel LGA 775, Intel Core 2 Extreme, Core 2 Quad, and Core 2 Duo processors **Chipset:** Intel P45 **Memory support:** Max memory: 16GB DDR2-1200, four DIMM slots

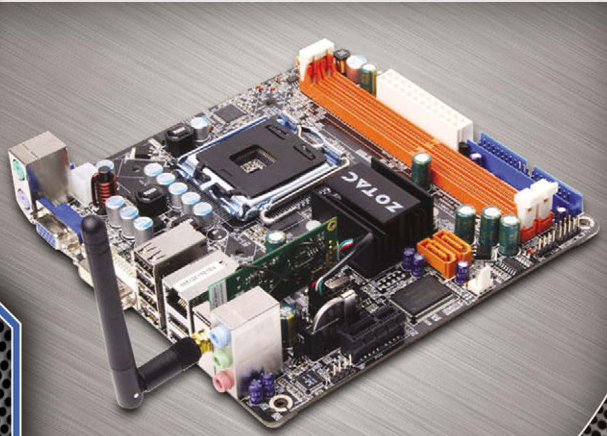
Gigabyte GA-E7AUM-DS2H

$140 • www.gigabyte.us

Why we dig it: This Gigabyte motherboard includes an integrated Nvidia GeForce 9400 graphics processor and PCI-E x16 slot with Hybrid SLI support. An HDMI/DVI interface with 1080p and Blu-ray playback add to the motherboard's appeal.

Who should apply: System builders who want home-theater A/V outputs and the ability to overclock the processor and memory.

Socket type: Intel LGA 775, Intel Core 2 processors **Chipset:** Nvidia GeForce 9400 **Memory support:** Max memory: 16GB DDR2-800, four DIMM slots



Zotac nForce 630i-ITX WiFi

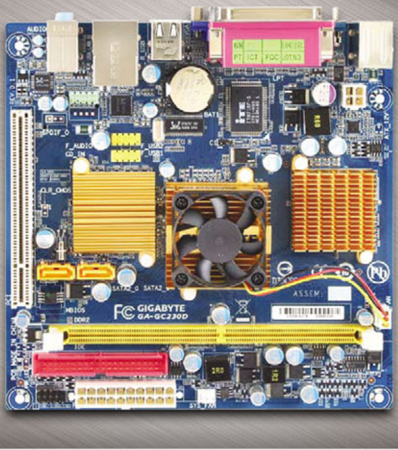
$110 • www.zotac.com

Why we dig it: With support for Intel Core 2 processors and a FSB speed of 1,333MHz, this model is ideal for users who require powerful processing from a small form factor. It includes an Nvidia GeForce 7100 integrated GPU, 802.11b/g, and six USB ports.

Who should apply: If you're building a miniature HTPC or barebones storage server, the Mini-ITX Zotac nForce 630i-ITX WiFi motherboard is perfect.

Socket type: Intel LGA 775, Core 2 Duo, Quad, and Extreme accepted **Chipset:** Nvidia GeForce 7100/nForce 630i **Memory support:** Max memory: 4GB DDR2-800, two DIMM slots

SPOTLIGHT



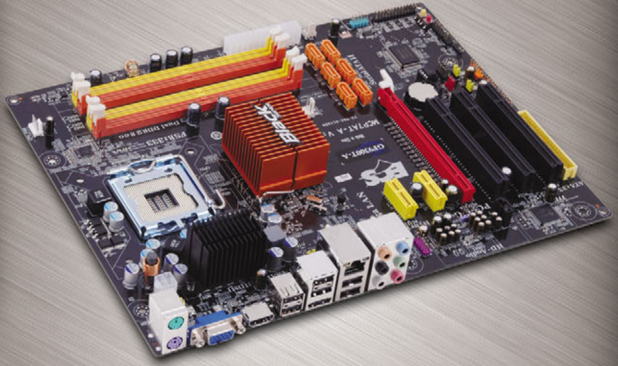
Gigabyte GA-GC230D

$110 • www.gigabyte.com.tw

Why we dig it: With Gigabyte's Conductive Polymer Aluminum Solid Capacitors, the GA-GC230D lets you use EasyTune to overclock the Atom 230 CPU.

Who should apply: Miniature PC owners who want to overclock the Intel Atom platform.

Socket type: Intel Atom 230 **Chipset:** Intel G45GC Express **Memory support:** Max memory: 2GB DDR2-533, one DIMM slot



ECS GF9300T-A

$109 • www.ecs.com

Why we dig it: It has the graphics power for Blu-ray and HD video playback and can run DirectX 10 games (although at a low resolution). Additionally, it includes a number of power-saving features and support for up to 32GB of RAM—8GB per DIMM slot.

Who should apply: This motherboard is best for those building an entry-level system or HTPC and who need an affordable platform that supports powerful hardware.

Socket type: Intel LGA 775, Intel Core 2 Quad or Duo processors **Chipset:** Nvidia GeForce 9300 **Memory support:** Max memory: 32GB DDR2-800, four DIMM slots

Intel D945GCLF2

$89 • www.intel.com

Why we dig it: This motherboard features Intel's dual-core Atom 330, running at 1.6GHz and a TDP of 8W. It offers two SATA connections, four USB 2.0 ports, and one PCI slot.

Who should apply: Netbook builders who want dual-core processing power.

Socket type: Intel Atom 330 **Chipset:** Intel 945GC Express **Memory support:** Max memory: 2GB DDR2-667, one DIMM slot

AMD BOARDS

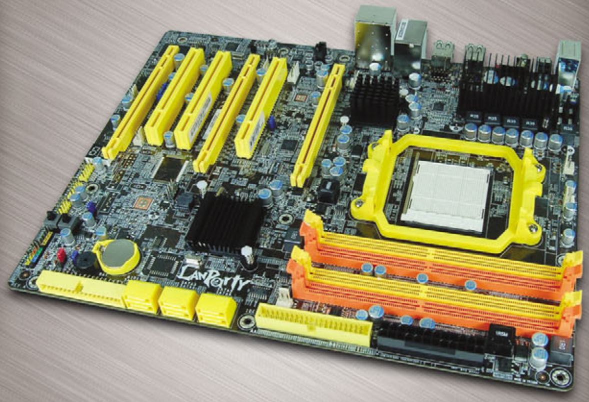
MSI K9N2 Diamond

$250 • www.msicomputer.com

Why we dig it: MSI's K9N2 Diamond lets you set up 3-Way SLI with your AMD AM2/AM2+ processor. MSI also includes a Creative SB X-Fi Xtreme audio card and two eSATA ports.

Who should apply: Gamers with Nvidia graphics cards who want 2- or 3-Way SLI.

Socket type: AMD AM2/AM2+, can run AMD Phenom processors **Chipset:** nForce 780a **Memory support:** Max memory: 8GB DDR2-1066, four DIMM slots



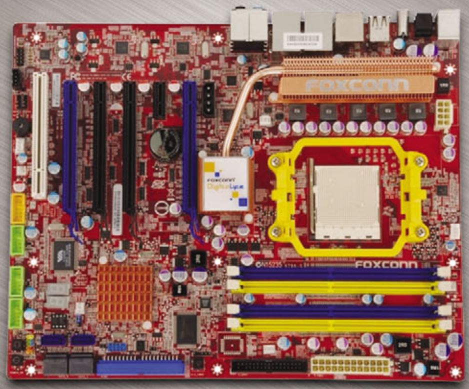
DFI LP UT 790FX-M2R

$230 • www.dfi.com.tw

Why we dig it: This DFI board can run AMD's Phenom processors with HyperTransport 3.0. Additionally, DFI includes its "Transpiper," a heatpipe assembly that extends outside the PSU fan to carry out board heat.

Who should apply: With support for CrossFireX, this board is ideal for power users who want to get the most out of their AMD products.

Socket type: AMD AM2/AM2+, triple- and quad-core Phenoms **Chipset:** AMD 790FX **Memory support:** Max memory: 8GB DDR2-1066, four DIMM slots



Foxconn A79A-S

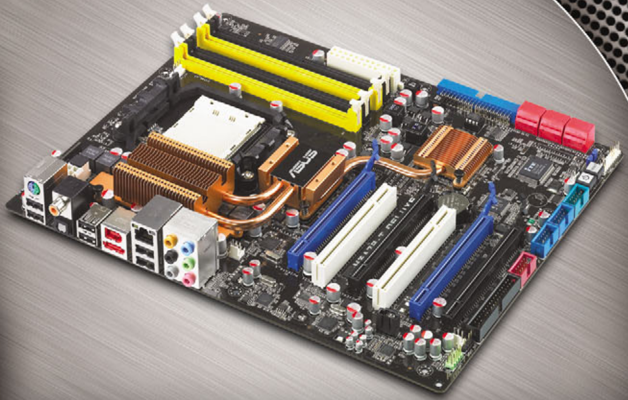
$225 • www.foxconnchannel.com

Why we dig it: Based on AMD's 790FX chipset, the Foxconn A79A-S provides dual digital audio (S/PDIF and optical) functionality to let you separate two sound sources from your PC. It also features dual Gigabit LAN ports to let you share an Internet connection with a second computer.

Who should apply: AMD processor and ATI graphics card users who want a motherboard with a lot of connectivity options.

Socket type: AMD AM2/AM2+ AMD Phenom and Athlon processors **Chipset:** AMD 790FX **Memory support:** Max memory: 8GB DDR2-1066, four DIMM slots

SPOTLIGHT



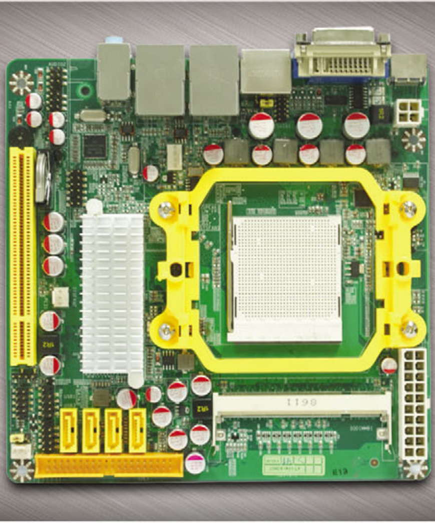
Asus M3A79-T Deluxe

$199.99 • usa.asus.com

Why we dig it: The Asus M3A79-T Deluxe can run CrossFireX with two (both x16 speed), three (x16, x8, and x8 speed), or four (all x8 speed) ATI graphics cards. The board also features Asus 8+2 phase power design that dedicates power to the integrated memory controller and HT bus.

Who should apply: Gamers who want a board that supports the hardware they need to push frame rates without breaking their budget.

Socket type: AMD AM2/AM2+, AMD Phenom processors **Chipset:** AMD 790FX **Memory support:** Max memory: 16GB DDR2-1066, four DIMM slots



Jetway NC81-LF

$160 • www.jetway.com.tw

Why we dig it: If you're building an HTPC in a cool book- or cube-style case, the Jetway NC81-LF, which features AMD's 780G chipset, provides the graphics and processing power you need for HD playback. Jetway used SO-DIMM slots for memory, which helps you save space in a small case.

Who should apply: Media PC builders who want a Mini-ITX motherboard that provides good integrated graphics power.

Socket type: AMD Socket AM2, AMD Athlon or Operton processors **Chipset:** AMD 780G **Memory support:** Max memory: 4GB DDR2-800, two SO-DIMM slots

DFI JR 790GX-M2RS

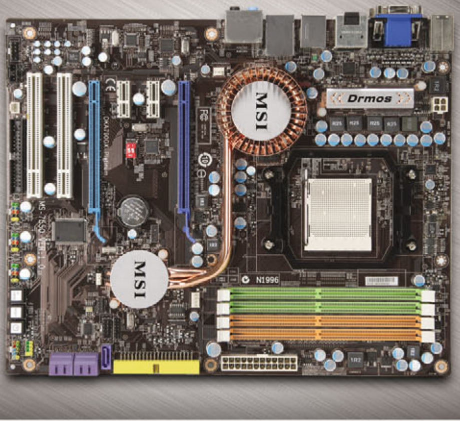
$160 • www.dfi.com.tw

Why we dig it: A micro-ATX board with an integrated AMD 790GX graphics core and two full-length PCI-E x16 slots for CrossFireX functionality. Each graphics card operates at x8 bandwidth. Fluorescent slots and connectors look cool when you install UV lights in your case.

Who should apply: People who want a micro-ATX board that can handle two ATI graphics cards running in CrossFireX.

Socket type: AMD AM2/AM2+, AMD Phenom with HyperTransport 3.0 **Chipset:** AMD 790GX **Memory support:** Max memory: 8GB DDR2-1066, four DIMM slots

AMD BOARDS



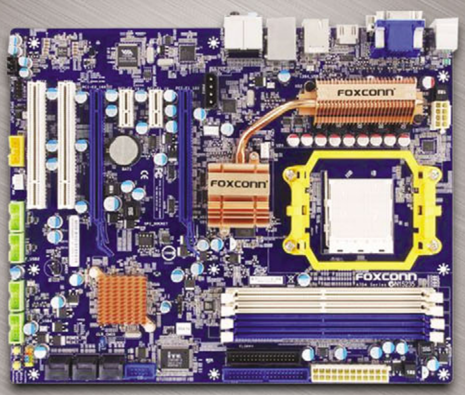
MSI DKA790GX Platinum

$154.99 • www.msicomputer.com

Why we dig it: We got to check out the DKA790GX in a recent HTPC build and were impressed by its Radeon HD 3300 GPU core. For its price, the inclusion of easy overclocking features and HDMI outputs are bonuses. You can use CrossFireX via the two PCI-E x16 slots, a single card with Hybrid CrossFire, or simply the Radeon HD 3300 GPU core.

Who should apply: The DKA790GX Platinum has the chops to grow with you, so it's a great starter motherboard for those who may want to later improve their system.

Socket type: AMD AM2/AM2+, AMD Phenom and Athlon 64-bit processors **Chipset:** AMD 790GX **Memory support:** Max memory: 8GB DDR2-1066, four DIMM slots



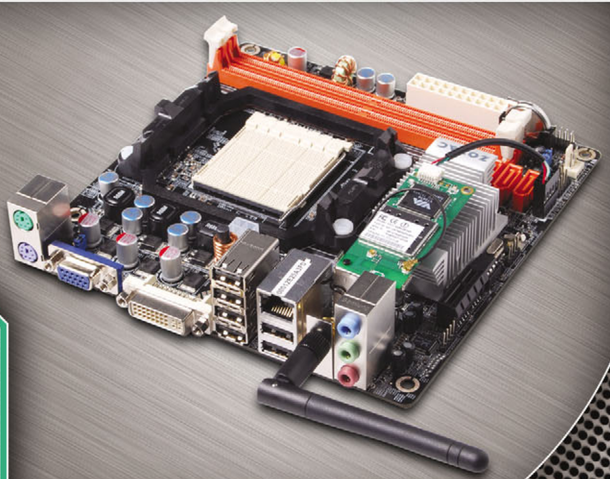
Foxconn A7DA-S

$125 • www.foxconnchannel.com

Why we dig it: Based on AMD's 790GX chipset, Foxconn features a 4+1 phase power design to limit power consumption and maintain system stability. Foxconn takes greater advantage of the 790GX's side-port memory by including a 128MB DDR3-1,333MHz chip.

Who should apply: This board includes a number of overclocking features, ideal if you want to push your AMD processor and system memory.

Socket type: AMD AM2/AM2+, including support for 140W Phenom processors **Chipset:** AMD 790GX **Memory support:** Max memory: 8GB DDR2-1066, four DIMM slots



Zotac GeForce 8200-ITX WiFi

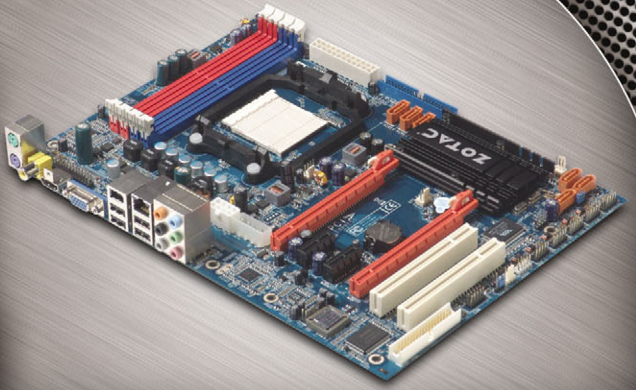
$100 • www.zotac.com

Why we dig it: With its Mini-ITX form factor and built-in Wi-Fi, this board is great for HTPC builds. An integrated GeForce 8200 GPU with DVI port and HDMI dongle provide the HTPC video goodies.

Who should apply: AMD Phenom fans looking for a Mini-ITX motherboard.

Socket type: AMD Socket AM2+, AMD Phenom and Athlon 64-bit processors **Chipset:** Nvidia GeForce 8200 **Memory support:** Max memory: 8GB of DDR2-1066, two DIMM slots.

AMD BOARDS



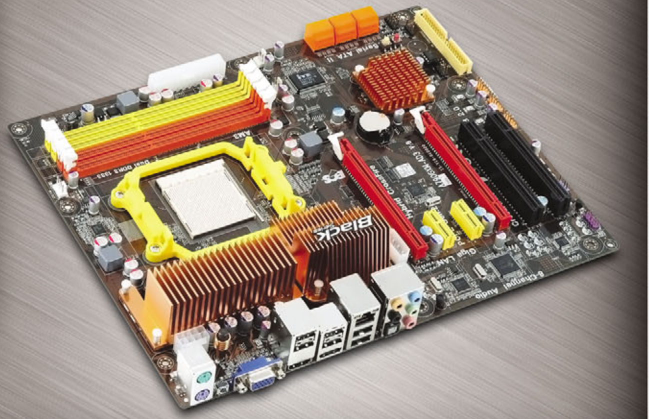
Zotac nForce 750a SLI

$100 • www.zotac.com

Why we dig it: This board supports AMD's processors that use the AM2+ socket and 2-Way SLI (x8 speed). Its integrated GeForce 8200 graphics core can use Nvidia's HybridPower technology to maintain low power consumption by switching between the integrated GPU and an add-in card.

Who should apply: AMD processor owners who want support for 2-Way SLI and HyperTransport 3.0.

Socket type: AMD Socket AM2+, AMD Phenom, Athlon, and Sempron processors **Chipset:** nForce 750a **Memory support:** Max memory: 8GB of DDR2-1066, four DIMM slots



ECS A790GX-AD3

$95 • www.ecs.com.tw

Why we dig it: One of the first motherboard to support AMD's Phenom II processors, the A790GX-AD3 also includes ECS' Ultra I/O Rear panel, with six USB ports, one eSATA port, and a Gigabit Ethernet port. The HD3300 integrated graphics core can run in ATI Hybrid Graphics mode with select ATI graphics cards.

Who should apply: Enthusiasts who want a board that supports the AMD's new 45nm Phenom II processors.

Socket type: AMD Socket AM3 45nm Phenom II **Chipset:** AMD 790GX **Memory support:**: Max memory: 32GB DDR3-1333, four DIMM slots

ECS A780GM-A Ultra

$90 • www.ecs.com.tw

Why we dig it: Motherboards with the 780G chipset offer good value, and ECS beefs up the A780GM-A Ultra by adding cooling on the northbridge and southbridge. Additionally, it supports the overclocking of 140W AMD Phenom processors.

Who should apply: The A780GM-A Ultra is perfect for those who want moderate gaming performance and the ability to overclock their processor.

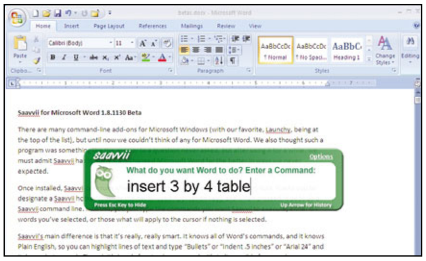
Socket type: AMD AM2/AM2+, handles both AMD Phenom and Athlon 64 models **Chipset:** AMD 780G **Memory support:** Max memory: 8GB DDR2-1066, four DIMM sockets

SPOTLIGHT

The Bleeding Edge Of Software

Inside The World Of Betas

Saavvii for Microsoft Word 1.8.1130 Beta



Saavvii for Microsoft Word 1.8.1130 Beta

There are many command-line add-ons for Microsoft Windows (with our favorite, Launchy, being at the top of the list), but until now we couldn't think of any for Microsoft Word. We also thought such a program was somethi

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expected.

Once installed, Saavvi

designate a Saavvii ho

Saavvii command line.

words you've selected, or those what will apply to the cursor if nothing is selected.

Saavvii's main difference is that it's really, really smart. It knows all of Word's commands, and it knows Plain English, so you can highlight lines of text and type "Bullets" or "Indent .5 inches" or "Arial 24" and

What do you want Word to do? Enter a Command:

insert 3 by 4 table

Saavvii for Microsoft Word 1.8.1130 Beta
Publisher and URL: Software Theories
www.softwaretheories.com
ETA: Q1 2008
Why Should you Care: Make MS Word jump through your hoops; not the other way around.

There are many command-line add-ons for Microsoft Windows, but until now we couldn't think of any for Microsoft Word. We also thought such a program was something like the answer to a question never asked, but after using it for a while, we must admit Saavvii has in many ways changed Microsoft Word for the better in ways we never expected.

Once installed, Saavvii only runs when Microsoft Word (version 2003 or greater) runs. It asks you to designate a Saavvii hotkey (such as the never-used Application key), and when pressed, it pops up a Saavvii command line. Into this, you just type the commands you want Saavvii to execute, either on words you've selected, or those that will apply to the cursor if nothing is selected.

Saavvii's main difference is that it's really, really smart. It knows all of Word's commands, and it knows Plain English, so you can highlight lines of text and type "Bullets" or "Indent .5 inches" or "Arial 24" and it does what you ask. Though it's handy for simple commands, it's indispensible for complex commands. Sure, you know the command to make a page with two columns of text (though with Saavvii you would just type "make two columns on page"), but did you know to go back to no columns on the next page you need to insert a Section Break? With Saavvii you can just type "end columns" and it knows what to do.

There's not much of a manual to speak of, but Saavvii doesn't really need one. Basically, as long as you aren't intentionally trying to confuse Saavvii with bizarre sentences or commands, it usually manages to intuit what you're trying to accomplish. Though we never tried it, if there was some way to integrate speech recognition with Saavvii's command line, Word would basically be able to read your mind, which thoroughly impresses us. ▲

by Warren Ernst

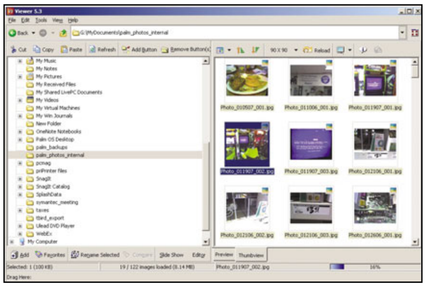
WildBit Viewer 5.3 Beta 1.0

Keeping track of photos and images has become one of the primary tasks of our computers, but Windows' own photo management tools are woefully inadequate for any but the most basic tasks. Though Google's Picasa has the "casual user market" completely locked up, there's plenty of room for tools aimed at more expert users, and the WildBit Viewer is among the faster of these expert tools.

WildBit Viewer claims to be powerful, stable, and light, and we agree. It consists of several modules, some of which simply aren't included with most image viewers, such as a basic editor that looks and feels a lot like a stripped down Paint Shop Pro. The main interface consists of the main Viewer window. Folders appear in the upper-left, while files appear in the lower-left, and a selected file appears on the entire right side. Alternatively, the right side can display thumbnails of the files in the selected folder, and WildBit Viewer generates thumbnails faster than most other programs. A toolbar button makes changing the size of thumbnails a quick procedure.

In addition to slideshow and file management abilities, WildBit Viewer has a very handy batch tool, capable of resizing, cropping, and changing file types automatically. Another handy tool is the side-by-side comparison tool. This seems basic, but most photos views lack this feature.

As a program for experts, there are tools like an EXIF data viewer and editor, dual monitor support, mass file renamers, and color histograms. For beginners, there are tools like auto red-eye elimination, Image Auto Adjustments (such as Auto Luminosity, Auto White Balance, and Auto Image Enhance), and slideshows with hundreds of different transition effects.



WildBit Viewer 5.3 Beta 1.0
Publisher and URL: WildBit Software,
www.wildbit-soft.fi
ETA: Q1 2008
Why You Should Care: A free, faster picture viewer than what comes with Windows is always handy.

We couldn't find any faults with the beta version and suggest it to anyone needing a step up from the photo tools that come with Windows. ▲

by Warren Ernst

UP TO SPEED

Upgrades That'll Keep You Humming Along

Just in time for the holidays, both Sony and Microsoft issue game console upgrades, and Windows Vista SP2 is previewed. Elsewhere, Google tweaks its new browser while Opera drops a new engine in its browser. Some old favorites, including VLC, SISandra, X-Setup, and CPU-Z are refreshed.

Software Updates

AnyDVD HD 6.4.9.0

The DVD backup tool adds support for recent protection formats. The update also includes fixes for reading nonencrypted data on encrypted BD/HD discs.

www.slysoft.com

CPU-Z 1.49

This favorite system diagnostic tool now supports the AMD Phenom II processor and latest Intel Core 2 chips. It loads faster and now has an online validation process, as well as a revamped Hall of Fame.

www.cpuid.com

Diskeeper 2009

The venerable defragmentation system retools its core engine in this release and promises faster file consolidation. The I-FAAST feature that accelerates the opening of frequently accessed files improves performance between 10 and 80%. A new Terabyte Volume Engine can reduce fragments on drives 60GB and up.

www.diskeeper.com

Foxit Reader 3.0

The low overhead, alternative reader/printer for PDF files now can play, edit, and delete multimedia in files. New Attachment, Thumbnail, and Layout panels give users a broader view of the documents and more flexible navigation.

www.foxitsoftware.com

Google Chrome 0.4.154.31

The Web browser from Google solves some program crashes in this release, as well as problems with trackpad scrolling on some laptops.

www.google.com

Opera 10.0 Build 1139 Alpha 1

The next generation of the popular alternative browser is available in a very early version. This browser's central feature is a new rendering engine for faster performance. This build also adds inline spell checking and upgrades the Opera Mail features with scheduled deletions and rich text composition. Versions are available for Windows, Mac, Linux, and FreeBSD.

www.opera.com

SiSoftware Sandra XII SP1

The first service pack for this exhaustive diagnostics tool adds new modules for benchmarking wireless performance, as well as tape and DAT performance. Compare your performance with peers by importing and exporting scores. This update also adds support for recent hardware releases.

www.sisoftware.net

Thunderbird 2.0.0.18

The Mozilla email client updates its recent major version release with this new security update that fixes some existing vulnerabilities.

www.mozilla.com

VLC 09.7

VideoLAN is a highly flexible multimedia playback engine. This version adds Ukranian localization. It also fixes overflow in CUE support from VCD access. Additionally, this release fixes overflow in RealText subtitles. There are separate versions of the update for Windows, Linux, and other OSes.

www.videolan.org

Windows Vista SP2 Beta

This service pack for Vista rolls up previous updates and security patches. It includes support for Blu-ray recording, as well as support for Bluetooth 2.1 and Windows Connect Now. This version can improve Wi-Fi performance, and it enhances performance of RSS feeds the Desktop gadgets. The service pack also replaces Desktop Search with a new version.

www.microsoft.com

X-Setup Pro 9.1

A mainstay for tweakers, X-Setup Pro now has full support for Vista, USB, and U3 sticks, and includes more than 2,000 adjustments for most Windows versions.

www.x-setup.com

Driver Bay

BlackBerry Storm 4.7.0.75

The first firmware update for the new touchscreen BlackBerry tries to address problems switching between portrait and landscape modes. It claims to improve multimedia playback, as well.

www.verizonwireless.com

New Xbox Experience

This major upgrade to the Xbox 360 radically overhauls the interface, with a look similar to the iTunes Cover Flow. The update also adds Wii-like avatars. Netflix subscribers now can access thousands of movies on demand. Film and TV catalogs now have full-screen previewing.

www.xbox.com

PlayStation 3 2.53

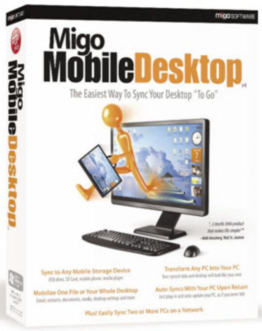
This firmware update for Sony's game console now has a new PlayStation@ Network, improves playback quality in several PS3 game titles, and enhances BD/DVD video performance in some action scenes.

www.us.playstation.com/PS3

Migo Mobile Desktop 4

For those who often hop from one computer to another, mobile desktop software is quite helpful. You can simulate your primary PC's desktop on a host PC and then have access to files, some programs, email (including calendar and contacts), Internet browsers, and chat histories. While Migo's Mobile Desktop 4 is a useful program, it's not without limitations.

Mobile Desktop 4 will only synchronize Outlook, Outlook Express, Thunderbird, Lotus Notes, and Windows Mail email clients, and support for Internet browsers is limited to Internet Explorer and Firefox. Also, Yahoo!, Microsoft Live, and AIM were the lone instant messaging programs supported. For avid Google users like me, this is a real con. One cool feature that Mobile Desktop 4 has, however, is Universal Mail. It converts Outlook, Outlook Express, and Windows mail into a universal format compatible with each of the other formats.



You can synchronize all of the aforementioned programs onto a removable device, or you can synchronize information among up to three PCs on a single network; therefore, if you have both a laptop and a PC for work, you can set up an automatic synchronization schedule to ensure information gets transferred between the two.

When you're using Mobile Desktop 4 with a removable device, it takes a while to boot your desktop on host PCs. So, if you're in a hurry, you can access all of your documents by opening the folder on your device that houses your primary PC's files.

The biggest benefit of using Migo's Mobile Desktop 4 vs. other mobile desktop programs, such as MojoPac, is its support for Vista. Not only can you use Migo Mobile Desktop 4 on Vista (something you can't do with MojoPac), you can easily switch between the two.

It's important to note that you will be limited by your host computer's technologies. If you typically run Outlook and Word 2007, for example, and your host computer runs the 2003 versions, you're stuck with that. That's an important distinction if you are choosing between mobile desktop software and remote desktop software. ▲

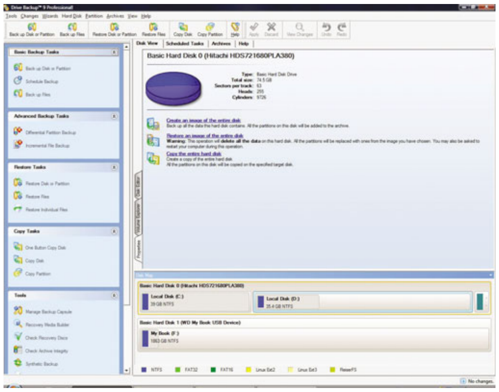
by Tessa Breneman

Mobile Desktop 4
$49.99
Migo
www.migosoftware.com
●●●

Paragon Drive Backup 9.0 Professional

If you're serious about backing up your entire system—for both personal and professional reasons—then this is the type of backup software you want. It has a robust list of features and capabilities, and it includes advanced features for power users, such as differential partition backup and the ability to avoid MBR restrictions. To use Drive Backup 9.0 Pro, however, you have to know your way around backup software. While it has a fairly user-friendly interface, it's likely that novice computer users wouldn't know how to utilize the advanced features.

Paragon has added some great new features to its Drive Backup Pro software, including support for Apple Boot Camp, Blu-ray Discs, and both 32- and 64-bit Windows Vista OSes, which makes Drive Backup 9.0 more comprehensive and flexible for both power users and work-from-home professionals. I also liked that Paragon added support for flash memory devices, so you have more options available to you in regards to constructing external recovery media.



Drive Backup 9.0 isn't image heavy, but the main art is a pie chart with hard drive information (type, size, sectors per track, heads, and cylinders) listed. You can also view both local drives if you have a dual-boot computer. Under the chart, you can click to create an image of your hard drive, restore an image, or copy the whole hard drive. You can also view the volume and the disk editor on the main display.

The side panel includes basic functions, such as back up a drive, partition, or individual file, and advanced options, such as differential partition backup and incremental file backup. You can also select to restore items via the side panel.

I didn't have any problems backing up my local hard drive or my files to a Western Digital external hard drive, or to a set of discs, nor did I have problems restoring individual files.

I also backed up my local drive using the Best Compression format and password protection. It shaved time off of the backup process and my 39GB drive was reduced to 27.4GB. ▲

by Tessa Breneman

Drive Backup 9.0 Professional
$69.95
Paragon
www.drive-backup.com
●●●●

CPU RANKING ○ 0 = ABSOLUTELY WORTHLESS | ●●◖ 2.5 = ABSOLUTELY AVERAGE | ●●●●● 5 = ABSOLUTELY PERFECT

by Chris Pirillo

The Part-Time Hermit In The 21st Century

The hermit lifestyle used to be a real drag. Removed proximity to civilization was the only way that the hermit's desire to be left alone might be respected, but such seclusion was certainly an all-or-nothing commitment. Would it be a lifetime of never-ending solitude or nonstop social interaction?

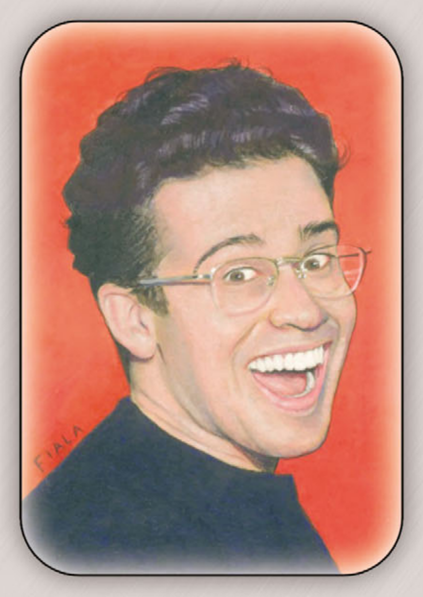
How many among us would be 100% satisfied with either choice? And would such a decision, on either end of the spectrum, be ultimately healthy? I think most of us like being able to keep pace with, and be part of, our society, as long as we have the option to retreat and recharge as the whim strikes us.

Ideally, we're part-time hermits.

The part-time hermit didn't become a possibility until technology intervened to connect the scattered pockets of humankind from across the globe.

Before computers, telephones, telegraphs, carrier pigeons, pony expresses, packet ships, tribal drums, and coconuts connected by monkey guts, a hermit who legitimately just wanted to get away from it all didn't really have a fair share of ways to make it happen. If he really didn't care to have anything to do with other members of the human race, he could just be a shameless jerk and pretend not to hear the voices calling from across the savannah—though not as effectively as he could later ignore his email (while safely retaining at least an illusion of affability to anyone paying attention). Every step forward that technology takes gives the modern, part-time hermit more options for seclusion and (this is the important part) interaction with others. See, the part-time hermit doesn't have to settle for being a recluse.

You may appreciate the serendipity of food shopping in a brick-and-mortar. I do not. Instead of spending two hours wandering aimlessly around the grocery store, I prefer to buy my nonperishable items online. Amazon is now delivering groceries, and I swear I get a coupon for free delivery from Safeway every other day. I would be surprised if you didn't have some chain in your neck of the woods that extended a similar courtesy.



Chris Pirillo has decided to live out his life in front of a live video camera, streaming his daily home office experience on the Internet for hundreds of people to watch at any given moment (even if he's not there) at live.pirillo.com. Sometimes, he's found blogging at chris.pirillo.com; other times, he's found updating bargains on coupons.lockergnome.com. Occasionally, he can be found interacting with fellow techies on geeks.pirillo.com. He doesn't feel alone, ever.

Instead of borrowing books from the library, I use services like Booksfree.com, which is like a Netflix for books. PaperBack Swap.com works just as well, as does BookMooch (www.bookmooch.com). My point is this: You're not stuck with what's on the local bookshelves anymore.

Instead of selling my used DVDs and CDs, I swap 'em out through swaptree (www.swaptree.com). That way, I'll receive more than 50 cents in return for my copy of Rick Astley's "Never Gonna Give You Up" album. Don't ask me why I have it, and don't ask me why I used to have the cassette version of it, either.

Instead of buying a cup of brewed tea, I buy bags in bulk and brew them at home. It kills me to see people paying for a "Venti Green Tips tea" at their local Starbucks only to be charged $2 for nothing more than hot water and two tea bags. You're kidding, right?! My current favorites are Peet's Genmai Cha and Bigelow's Eggnogg'n (seasonal, but good year-round).

Instead of driving across town for a meeting where someone plans on showing me a boring presentation, I offer the teleconference option instead. There are services, either free or fee-based, that will allow you to broadcast your Mac OS X or Windows desktop with ease. Enough with the freakin' PowerPoint already.

I can go an entire day without seeing a single human being and yet feel completely satisfied with my interactions with friends and colleagues online. We're communicating, we're joking, we're playing, and we're being ourselves. We're connecting—by choice. With the same level of choice, we can turn off our interfaces and go about our private business whenever we like. Online friends aren't just online friends. Perhaps, more than anything, my online friends get me more than someone who's a traditional friend. As part-time hermits, our synergy isn't offended by an absence of three-dimensional parley; it thrives on it!

Like you, I've got options. And I'm glad that I don't have to have it any other way. ▲

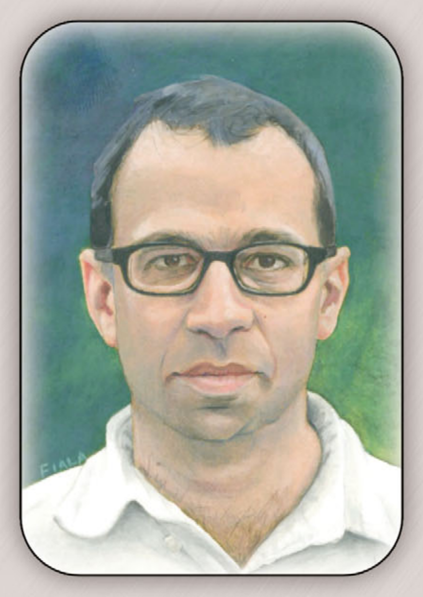
You can dialogue with Chris at chris@cpumag.com

Open Sauce

by Peter Loshin

Alternatives To Shutting Down In Linux (And Why They Suck)

Do you know the difference between hibernate, sleep, suspend, and standby modes? I didn't. It turns out that when you hibernate, your PC saves the current state of the your system onto your hard drive, and then it shuts down altogether; when you resume, the PC starts up again and loads the system state back into RAM from storage. Suspend (also known as sleep or standby) mode turns down the power to your hard drive, monitor, and anything else that can be safely powered down, saving the system state into RAM. When you're ready to work again, the OS restores the power to the affected components, and you're good to go . . . in theory.



Peter Loshin publishes LinuxCookbook.com, a place to learn even more about Linux. And don't forget to check out the new Ninitata.com, Peter's family-friendly fun and learning site.

In theory, it should be pretty easy. But in practice, at least for Linux, it's not so easy.

Of course, hibernate, et. al, are especially important to portable PC users because it's nice to be able to shut the case in the middle of a session and then resume work at the precise place and time when it's more convenient. "Instant on," as I discussed last month, would seem to be a better solution—but only if it's also "instant off," while, at the same time, saving system state (so you power up with the same apps and documents open to the same place as when you shut the system down). But this is more or less what hibernate does, which is why I said last month that hibernate (and sleep, etc.) is sort of an interim solution (that is, kludge) to solve the problem of how to minimize the amount of power a computer uses, while at the same time making it as close to instantly usable as possible.

So let's talk about the theory. Unlike a lamp, say, which is either on or off, PCs have component devices and subsystems—drives, fans, CPUs, USB interfaces, and so on—each of which can be powered on or off. For example, on my desktop, the system notifies the monitor to go into its own sleep mode after 30 minutes of inactivity. That works pretty well under Linux.

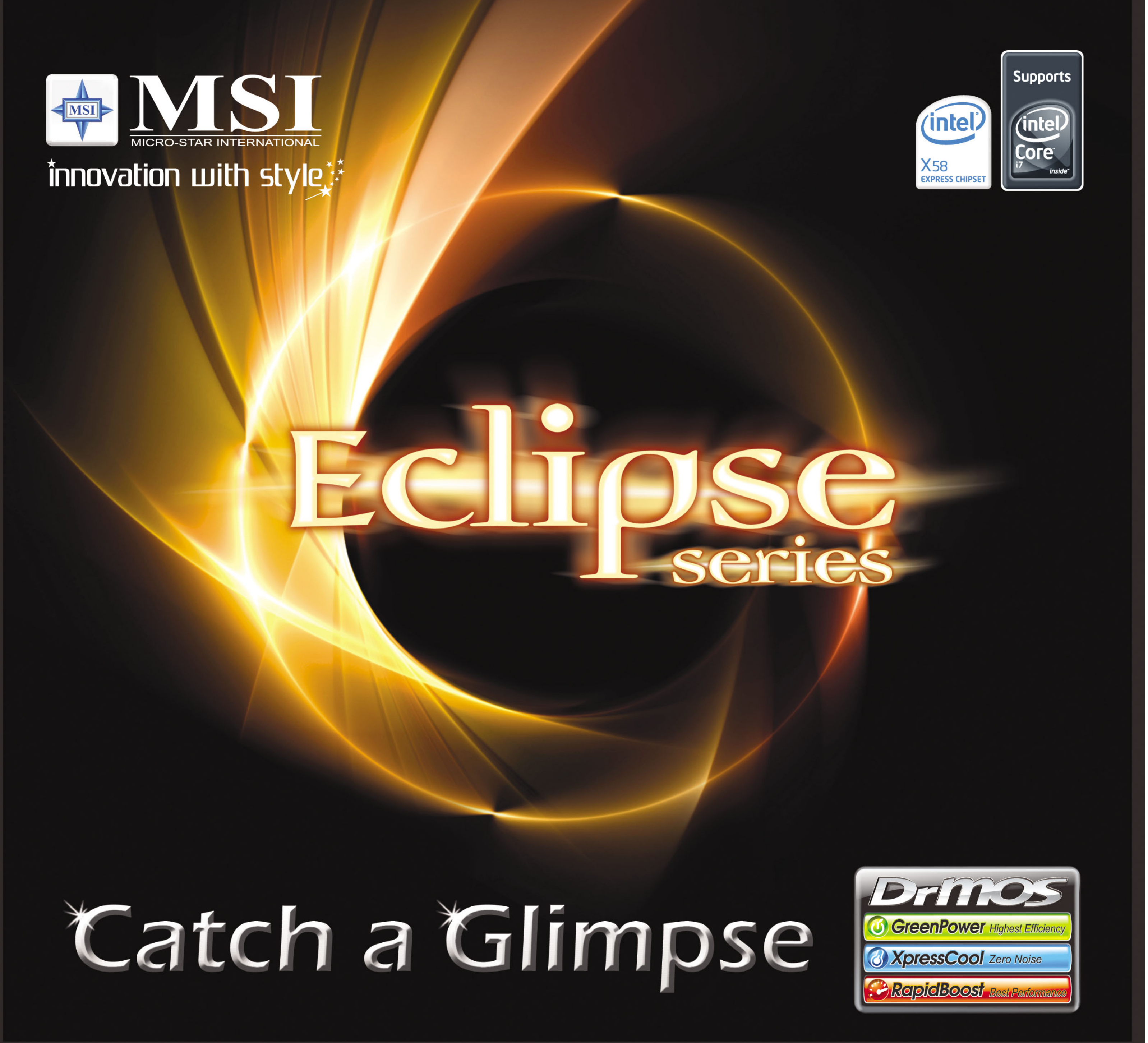
Over a decade ago, HP, Intel, Microsoft, Phoenix, and Toshiba teamed up to create industry-standard interfaces to "enable OS-directed configuration, power management, and thermal management of mobile, desktop, and server platforms"; in 1999, the group published the ACPI (Advanced Configuration and Power Interface) open specification (www.acpi.info). The ACPI spec defines power states for the system, ranging from "Working," where everything is powered up, to "Mechanical Off," where everything is turned off and the system can be unplugged. ACPI defines four "sleeping" states for the system, as well as power states for system devices and the CPU. Thus, ACPI-compliant hardware should always be in one of the ACPI-defined states, with each device or CPU ranging somewhere from fully on to fully off.

"Hibernate" is ACPI State S4, which means the system has been powered off after storing the contents of system RAM to a nonvolatile medium; different "Sleep" states are defined in which system devices are powered down while RAM state is preserved. As long as the OS is ACPI-compliant, you should be able to go into sleep, standby, or even hibernate mode to save power and (virtually) instantaneously get back to work when you're ready.

That's the theory in a nutshell. In practice, with Linux for example, you can be ACPI-compliant and still have trouble getting sleep/hibernate to work. The reason? OEMs produce an ever-changing menu of PC models, with system boards, drives, video cards, and CPUs supplied by a number of manufacturers. Even if you could track down all the different manufacturers, you'd then have to deal with mostly proprietary (and sometimes buggy or non-standard compliant) drivers and firmware.

Sure, sleep/hibernate is just a workaround for really fast booting (as I said last month), but for now it's a necessary workaround. Linux lags badly behind Windows and OS X in power management. It used to be a lot worse, and it's certainly getting better. But Linux could do better still; until it does, it'll be a hard sell for the mainstream/enterprise laptop market. ▲

You can get saucy with Peter at pete@cpumag.com



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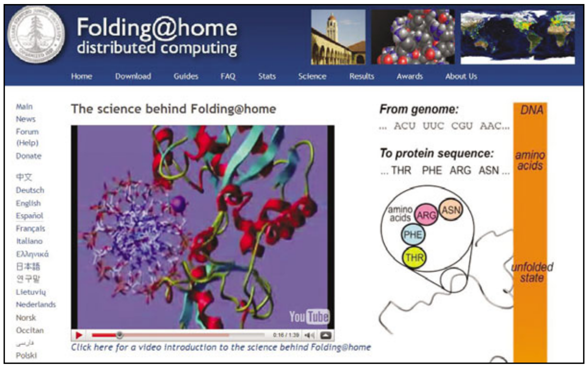
www.msicomputer.com

Charitable Computing

Brother, Can You Spare A CPU Cycle?

If that multicore, overclocked, computing hot rod on your desk with dual graphics cards is not playing Crysis every minute of the day, then it could be finding cures for cancer, scanning the cosmos for signs of life, or modeling viral outbreaks around the world. Worthy projects like Folding@home, SETI@home, GIMPS, and scores of others are hoping your computer can spare a few cycles to apply to massive computational projects that would choke any normal supercomputer. These increasingly popular and technically sophisticated programs use distributed computing methods to combine the spare cycles on millions of desktop computers around the world into enormous power. Many of these projects are poised to move to the next level by incorporating new distributed computing methods, as well as next-generation CPUs, GPUs, and even game machines. By harvesting the idle time and spare cycles from millions of common desktops, the processing potential is staggering. But are these projects paying off?



The science behind Folding@home

Click here for a video introduction to the science behind Folding@home

Like any charitable endeavor, even science-driven volunteer computing projects require self-promotion. Folding@home has excelled at keeping the owners of its 250,000 active CPUs informed and involved.

"Finding ET, we haven't done," says Dave Anderson, director, SETI@home, the legendary project started in 1999 that scans celestial radio signals for signs of intelligent extraterrestrial life. Anderson, a research scientist at U.C. Berkeley's Space Sciences Laboratory, says that SETI@home recently released a new application that re-examines data in a different way to find signs of natural phenomena like "evaporating black holes." "These are small black holes that lose mass and can evaporate in a poof that causes a radio click." Anderson believes the new SETI@home project will be able to detect and confirm something that until now exists only in theory. Meanwhile, at the GIMPS (Great Internet Mersenne Prime Search), members of that cooperative computing project claimed a major milestone just this summer, when contributing computers from a UCLA math lab discovered the largest prime number to date, with 13 million digits. The discovery of this massive number divisible only by 1 and itself qualifies the group for the Electronic Frontier Foundation's $100,000 Cooperative Computing Award. "We thought the 10-million-digit level would be difficult to achieve," says Landon Curt Noll, Technical Leader, Cisco Advanced Research and Architecture Group and board member for the EFF award. Noll likens the process to searching for a needle in a haystack by dividing up the hay into thousands of small piles for individuals to probe. "Each can say he found a needle or didn't find anything. A collection of machines each working their own tests would be able to find it with enough perseverance and coordination."

Unlike the grid computing that many enterprises use to leverage multiple computers for a given task, volunteer computing has special challenges. They both use forms of distributed computing, which parses a problem out as small tasks to multiple PCs at once. But grid computing is a two-way affair, where all computers on the array can run computing jobs. Volunteer computing is a one-way path that has to keep the end user interested in the job at hand. Volunteer computing also relies on amateurs who operate anonymously, and so the software must be easy to install and accommodate a variety of operating system versions. Anonymity breeds hacking, and so many cooperative projects have to protect against hackers who plant bad results. Many volunteer programs actually run the same job on multiple PCs and then compare the results to detect mischief.

Beyond advancing physics and math, many of these volunteer computing projects are working on real-world problems. The AfricanClimate@home project helped form more accurate climate models for regions in Africa. Malariacontrol.net has 10,000 volunteers contributing more than 10,000 years of CPU time to modeling malaria, which has already resulted in published work that is helping develop appropriate vaccines. The very popular Folding @home project (see sidebar) maps protein molecules and has already resulted in almost 50 peer-reviewed papers advancing our understanding of cancer, Alzheimer's, and Parkinson's disease.

A Spirit Of Cooperation & Competition

In some ways, the overarching goal of projects such as SETI@home, GIMPS, and Folding@home, all of which began in the 1990s, has already been achieved in that they created platforms and a movement that involves volunteers in aggregating computing power. Perhaps the most important contribution of SETI@home so far has been in the software, the development of the BOINC (Berkeley Open Infrastructure for Network Computing) platform that over 50 @home projects of all sorts now use. Until the arrival of BOINC several years ago, each volunteer project required its own client software that shared CPU cycles with the larger program. Anderson, who created BOINC, says this new approach encourages users to volunteer for multiple projects via one client program. "You can sign the computer up for any of these projects and control the amount of computer time that goes to each one." BOINC currently has an installed base of 550,000 computers, mainly Windows PCs, and it is supported by the National Science Foundation. The majority of participants divide their CPU cycle contributions across multiple causes. "We

Q&A: The Father Of Folding@home

Among the most popular and well-known volunteer computing projects, Folding@home explores protein simulations and pursues research in cancer, HIV, and Parkinson's Disease. The program started in 2000 and boasts hundreds of thousands of active contributors. Director of the project and Stanford Chemistry Professor Vijay Pande tells us that his project is also at the leading edge of cooperative computing technologies, and the first to embrace GPUs, as well as the Sony PS3, to handle calculations.

CPU: I think most people who contribute to Folding@home want to know whether their contributions have paid off yet in any research advances or discoveries. Do you share details of the advances?
Pande: Yes. We have a Results link on our Web site at folding.stanford.edu/English/Papers. There are many results from the project, 57 as of today in terms of peer-reviewed scientific advances.

CPU: Are you using a proprietary platform for distributed computing or one of the standard engines that many such projects use?
Pande: We are using our own platform. That has given us a lot of flexibility, particularly in terms of moving calculations to GPUs and the PS3 and using tightly coupled multicore calculations, all firsts for Folding@home.

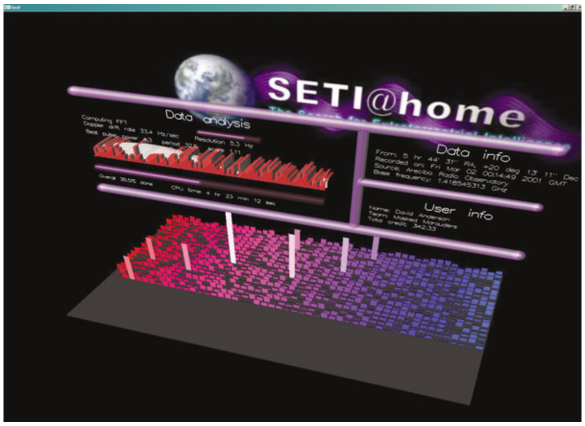
CPU: What has been the growth curve in participation in the past year or so?
Pande: We've added about 40,000 CPUs pretty steadily every year.

CPU: What computing platforms are the biggest contributors?
Pande: In terms of numbers, it's Windows CPUs. In terms of FLOPS, it's GPUs. Note that Folding@home puts out over 4 PetaFLOPs these days on average. That's four times more than the fastest "traditional" supercomputer in the world.

CPU: In addition to advances in chemistry, is Folding@home advancing the art of cooperative or volunteer computing?
Pande: Yes, we have been pushing the limits of what one can do with distributed computing. For example, we have very complex server-side calculations used to combine all of the distributed calculations. Also, our push to GPUs and game consoles like PS3 represents a major step forward into new realms. Many areas we've been pushing into are bleeding edge.

CPU: Are you encountering challenges and problems in reaching across so many platforms?
Pande: Our multicore client uses a standard supercomputing library, which works well on Linux and OS X, but not on Windows. This created a major headache for us, as well as our donors. Also computing on GPUs in the lab is still very new, doing so "in the wild" on about 15,000 different GPUs is unprecedented and we are learning various lessons with running production code on GPUs.

CPU: Are there commercial applications for cooperative computing beyond scientific research? Can this harvesting of spare CPU cycles become a more efficient way of redistributing computing power?
Pande: I can imagine this. For example, distributed computing could work very well to render Pixar movies and the like. There are a lot of possible applications. The challenge is that people are donating their computer time, so it has to be for a charitable purpose.



The Berkeley BOINC project, which runs SETI@home, lets users parse their contributed computing time across fifty different volunteer projects from a single piece of client software.

are trying to move away from a model where people got attached to one project," he says. "The goal of BOINC is to have a large and dynamic set of projects and have people constantly looking around for what is available."

In fact, having hundreds of programs and hundreds of thousands of volunteers involved in volunteer computing makes a spirit of competition inevitable both within and across the platforms. With so many options available to BOINC users, for instance, individual projects have to market themselves more effectively. In the past, researchers often set up volunteer computing programs, attracted a base of users, and then forgot to communicate with the troops. Now that volunteers can switch their CPU time among causes with a single interface, researchers must learn to work in a charity marketplace. "The fact is there are people behind those computers, and they need reassurance that they aren't just wasting electricity," says Anderson. One of the challenges for volunteer computing projects is having the research teams devote time and resources to community cultivation. "Projects attract users by doing good science and by having Web sites that have up-to-date news and interesting message boards," he says.

Self-promotion has been a strong suit of Folding@home, which hosts a multilingual Web site that includes videos of the protein models it has created and an impressive list of publications. The director of Folding@home, Vijay Pande, boasts that unlike BOINC and other distributed computing approaches, its home-grown software took the lead in using the GPUs in desktop graphics accelerators and now even Sony PS3s. By scoring the computing contributions each user makes to a project, endeavors such as Folding@home have inspired "teams" that combine their points to vie against one another. The tech site [H]ardOCP sits atop the Folding@home leaderboard with over 1,400 active members and 1.1 billion points of CPU contributions.

And there is also some competitive friction across technologies. In September, BOINC's Dave Anderson asked that the EFF open its Cooperative Computing Awards to volunteer endeavors perhaps larger than finding prime numbers. "This program, though admirable, needs an update," he wrote in an open letter. "Finding large prime numbers is not science: it doesn't prove or disprove any conjecture." He asked for EFF awards for discovering new drug candidates or ET via volunteer efforts. Noll counters that awarding the search for larger primes has a particular function. The anonymous donor of the award was interested in designing milestones that would "spur innovation and cooperation on large-scale computing projects in new and interesting ways." Noll praises the various @home projects like Folding@home and others for "achieving significant milestones in their ability to coordinate and inspire work on fun and useful problems," but he feels that it requires computer scientists to move cooperative computing to the next stage of technical sophistication. "We felt that at this stage some serious innovation has to come into play."

Next@home

In fact, the field of cooperative computing seems on the brink of a new stage on a number of fronts. Anderson is enthused with the prospect of adding graphics processor support to BOINC. Tools such as Nvidia's CUDA (Computer Unified Device Architecture) let programmers access the massive parallel processing power of GeForce cards. "GPUs are the future," he says. "They are anywhere from 30 to 50 times as fast as CPUs, and it is increasingly feasible to program them for scientific computing. It will enable new types of science to happen." And as Pande finds at Folding@home, GPUs can quickly surpass the CPUs in running a volunteer project.

But Noll warns that the real next stage in cooperative computing will move beyond throwing more raw power at problems. It will require changing the algorithms and the way that work is shared among systems. Divvying up computational challenges into so many small piles of hay that each PC can search within for a needle takes us only so far. The next stage of the prime number challenge, reaching a 100-million-decimal-digits number, will require numbers so large that multiple machines will have to work simultaneously on the same calculation. "If we say you aren't finding a needle but weaving a matt, and it takes coordinating with neighbors, that will require a different type of cooperation," Noll says. This scenario requires new ways of parsing a single, enormous calculation and tools for managing the bandwidth and working memory available among the machines. He estimates that using the current standard method of cooperative computing, even with all of the newfound power of multicore CPUs and GPUs, it would take until 2015 to find the 100-million-decimal digital prime. He says the game is not about raw speed and cycles, but coordination. "We can change the setup to give each machine a smaller chunk of work and use the network bandwidth to combine the results." The next stage of cooperative computing won't be competitions for who produces the most floating point calculations. "You can be very fast in producing wrong results," says Noll. "But a slow correct answer is infinitely preferable to fast incorrect answers." ▲

by Steve Smith

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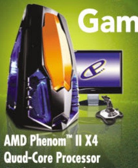

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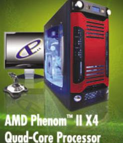

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by Rob “CmdrTaco” Malda

Build.txt

The open source world has started a trend that the videogame community is paying close attention to. And as the economy crumbles, a lesson emerges that will only become more important to both groups. Get the end users involved in creating the product.

Last year marked the next logical step in the world of player-created content for mainstream video games. Major A-List titles incorporate player designs into gameplay, not as an afterthought, but as a core part of the system design. In the case of Spore, your curiously evolved creatures are uploaded to the world, and your gaming experience routinely brings you into contact with the spores of strangers around the globe.

In the case of LittleBigPlanet, the game itself is turning into the act of level creation. Players unlock objects and eventually can construct entire levels that they can share with the world. The complexity of these levels is visible on YouTube, ranging from creative interpretations of movies or other games to detailed and practical levels that demonstrate the internal workings of a virtual calculator built entirely out of pulleys and gears. It simply has to be seen to be believed.

These ideas have been a long time coming. Doom was the first game that really started being “modded,” but in the early days, it was all underground. At the peak of its popularity, players were replacing demons with flying Homer Simpson heads and eventually building entire maps for the game. A game such as The Sims became a top seller for many years thanks in part to a steady stream of expansion packs, but more importantly because a massive population of builders constantly added new objects to the game. Your Sims were fun, but having the cast of Friends next door to the cast of Buffy the Vampire Slayer is a whole different experience.

These days, many first-person shooters ship with level creators, but the act of creation isn’t part of the game so much as a secondary action done after the fact. But drawing this arbitrary line between creation of content and playing content isn’t really necessary.

Rob "CmdrTaco" Malda is the creator and director of the popular News for Nerds Web site Slashdot.org. He spends his time fiddling with electronic gizmos, wandering the ’Net, watching anime, and trying to think of clever lies to put in his bio so that he seems cooler than he actually is.

As engineers, we know that the act of creation is tremendously fun and satisfying. For many people, the love of creation came long before the idea that you could actually be paid for it. Building the tools required to construct a game is often most of the work, and most of the fun. Software engineers love to build the jigs that they need to get their jobs done. Why wouldn’t we pass that fun along?

In the open source community, these facts have been known for years. It has led to the creation of countless useful tools in the GNU tool chain, programs that made it possible to create the applications that regular users come to rely on. You can’t have Firefox without a C Compiler, after all.

These days, an A-List gaming title requires millions of dollars to create. It seems to me only logical that, given the state of our economy, one of the best ways to cut the cost of game development is to make the act of level creation fun. Allowing users to share their creations will add countless playable hours to new games. And given that most games are trending toward 10 hours to complete, this will make everyone happier with their $60 investment.

The final step is to fully open up the entire act of game development and rely on subscription services and data exchange for revenue. Already many game makers have begun to do this: Games such as Guitar Hero and Rock Band have almost limitless replayability thanks to downloadable songs and even your own song-creation tools. The very best custom-created content could even result in revenue sharing. It’s a scary world where all of us are the builders.

With any luck, a new generation of kids will grow up expecting to create the virtual tools that they rely on every day. They will learn problem-solving skills that will directly translate to computer programming. Years from now, these concepts will simply be a part of their everyday thought processes. Many of them will logically return to the open source world and hopefully engineer more tools that will lead to the next generation of games. ▲

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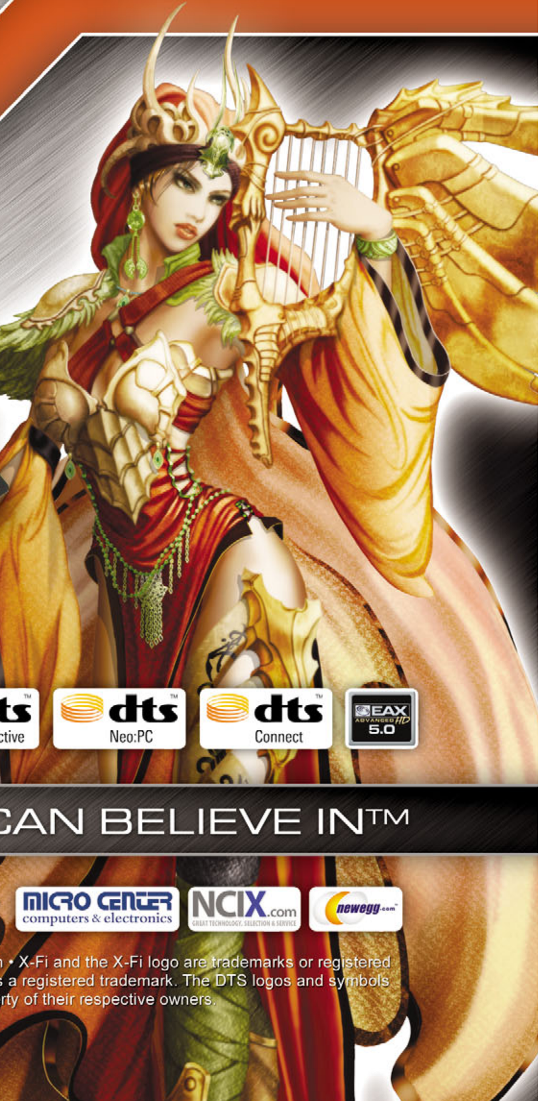

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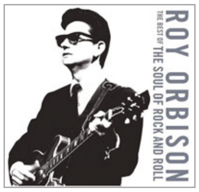
At Your Leisure

The entertainment world, at least where it pertains to technology, morphs, twists, turns, and fires so fast it's hard to keep up. But that's exactly why we love it. For the lowdown on the latest and most interesting releases in PC entertainment, consoles, DVDs, CDs, and just leisure and lifestyle stuff we (for the most part) love and recommend, read on.

Audio Video Corner

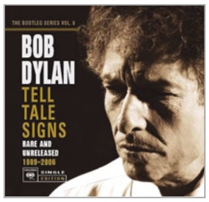
by Blaine A. Flamig



$31.99
Sony Legacy
www.royorbison.com

"The Soul of Rock and Roll"—Roy Orbison

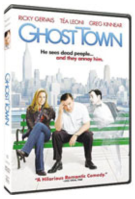
The famine of new music releases that typically happens every year around the holidays makes this a great time to explore the music missed during the prior 12 months, such as Roy Orbison's four-disc, 107-track "The Soul Of Rock and Roll," originally released in October 2008. Oozing with rock history and Orbison's unmistakable tenor voice, this set will melt even the iciest heart. Sony Legacy has gathered work from Orbison's stints with all the studios he recorded for, producing a complete taste of his life's work. A dozen previously unreleased tracks, soundtrack offerings, and work with the Traveling Wilburys are also included. If you've neglected Orbison's music before and after his 1988 death, "The Soul Of Rock and Roll" is the ultimate jumping-off point for getting familiarized.



$22.98
Columbia Records
www.bobdylan.com

"Tell Tale Signs: The Bootleg Series"—Bob Dylan

Another October 2008-released set, "Tell Tale Signs" from Bob Dylan illustrates several characteristics that Dylan's faithful have long known about America's best living songwriter. Dylan frustratingly often snuffs out many songs from ever seeing official release and is also known to so thoroughly alter songs during recording that they resemble little to nothing of the songs' original demos. The two-disc, 27-song "Tell Tale Signs" is full of such instances. Covering 1989 through 2006, "Tell Tale Signs" is a treasure chest of first-rate demos, live performances, unreleased tracks, and alterative takes Dylan recorded for soundtracks and sessions for "Oh, Mercy," "Time Out Of Mind," and "Modern Times." Magnificent on every front, there's a reason "Tell Tale Signs" is on dozens of critics' Best Of 2008 lists.



$19.99
Dreamworks Video
www.ghosttownmovie.com

Ghost Town

We tend to give Ricky Gervais a free pass across the board. His original and British rendering of "The Office" as writer, actor, and director took "uncomfortable humor" to new levels. In "Ghost Town" Gervais does a different kind of acting, and he's outstanding as Bertram Pincus, an insensitive British dentist living in America. Pincus' only wish is being left alone, especially after a botched surgery leaves him dead for several minutes and later able to talk to ghosts. The ghosts have unfinished business, and when they discover Pincus can speak to the living and dead, they want his help tying up loose ends. Bertram agrees to help Frank (Greg Kinnear), an unfaithful playboy husband, until he meets Frank's widow, Gwen (Tea Leoni), who he becomes smitten with. Watching a hapless hero chase romance hasn't been this much fun since Ben Stiller did it in "There's Something About Mary."

$19.99
Comedy Central
www.comedycentral.com/shows/roast_saget/index.jhtml

Comedy Central Roast Of Bob Saget

Like most holiday seasons, 2008 saw a dearth of new can't-miss movie releases on DVD. Still, some digging uncovered this treasure, although whether you consider Comedy Central's send-up of Bob Saget a gem or not greatly depends on your tolerance for foul-mouthed naughtiness. Without question, the Saget you'll find sitting in the hot seat here isn't the man who hosted "America's Funniest Home Videos" or played Danny Tanner, the lovable single father raising three adorable girls with help from uncle Jessie (John Stamos) and best friend Joey (Dave Coulier). Stamos emcees the roast (and takes a verbal beatdown), while the great Norm MacDonald, greater Cloris Leachman, and Comedy Central roast veterans Jeffrey Ross and Gilbert Gottfried also pile on the insults. You'll feel guilty for laughing, but you'll laugh.

See the full reviews from A/V Corner at www.cpumag.com/cpufeb09/AYL

DVD Byte

3/3

Beverly Hills Chihuahua

I Loved You So Long

3/10

Let The Right One In

Battle In Seattle

3/17

Rachel Getting Married

Van Wilder: Freshman Year

3/24

In The Electric Mist

In Treatment

3/31

Ricky Gervais Out Of England: The Stand-Up Special

CALL OF DUTY WORLD AT WAR

World War II In The Pacific Theatre — *by Dr. Malaprop*

Call Of Duty 4: Modern Warfare was a fast-paced RPG-style FPS that kept us playing well into 2008. CoD: World At War heads back to World War II. The game focuses on dual campaigns spanning 15 missions. One campaign features Private Miller in the Pacific theatre. The other campaign features Private Petronko as Russia pushes the Germans back to Berlin.

Strong support voice acting roles by Kiefer Sutherland and Gary Oldman help the narrative, but World At War does not resonate as emotionally as Modern Warfare—perhaps because of the jumping around between campaigns, or the step back to the overplayed World War II setting. The flamethrower in the single-player game had our attention, though.

World At War's not living up to Modern Warfare in the CoD series is not harsh criticism. It's a solid, entertaining game that's not groundbreaking but well worth playing. ▲

$59.99 (360, PS3); $49.99 (PC; Wii)
ESRB: (M)ature • Activision • www.callofduty.com

RESISTANCE 2

After The Fall Of Man — *by Dr. Malaprop*

In Resistance 2, you return as Nathan Hale almost immediately after the conclusion of the first game, knowing that an infection changed humans into the Chimera. As you may recall, Nathan was infected in the first game but never turned. Now, it's time for round two.

Resistance 2 fails utterly in its incoherent and generic single-player narrative. You don't care about the characters or even the bland protagonist. Ultimately, you just jump from scenario to scenario across the United States. Those scenarios provide background for some massive set-piece battles, but developer Insomniac didn't take the time to flesh out the story.

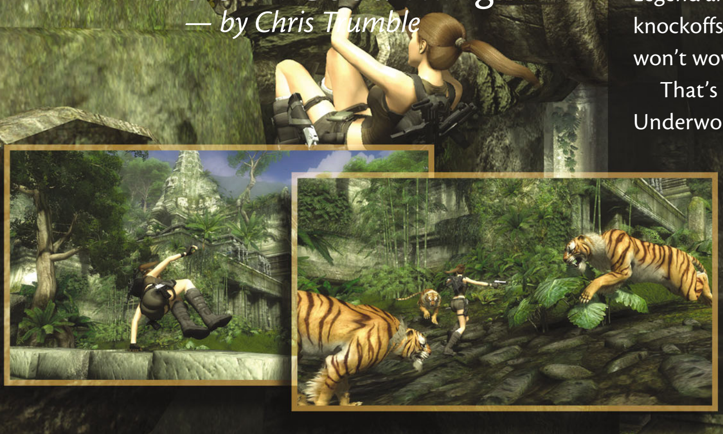
The single-player sci-fi campaign can be considered a training ground for the robust multiplayer options. The "co-op" game features a World Of Warcraft-style method of gaining XP and leveling up to eight players in the game universe. There's also 60-person multiplayer support with Deathmatch, Capture The Flag, and Skirmish modes. Pick the game for its multiplayer option and otherwise steer clear. ▲

$59.99 (PS3) • ESRB: (M)ature • Sony Computer Entertainment
www.us.playstation.com/PS3/Games/Resistance_2

TOMB RAIDER UNDERWORLD

More Of A Good Thing

— *by Chris Trumble*



When Eidos released Tomb Raider: Legend back in 2006, the game was a refreshing new take on an old favorite, including a dramatic revamping of the series' graphics sophistication and some new moves and control elements, to boot. If you played Legend and enjoyed the huge leap it represented from the seemingly endless stream of knockoffs of the original TR game, you should know that Tomb Raider: Underworld won't wow you that way; in fact, it very much looks and feels like a sequel to Legend.

That's not such a bad thing, though, as Legend was quite entertaining, and Underworld serves up a slew of lush new indoor and outdoor environments, a few new moves, and a (somewhat) new mystery to solve via adventures in exotic locations. The obligatory training session in Croft Manor very quickly gives way to gameplay that's a decent mixture of new and old elements, including a dash of combat, a smidgen of puzzle solving, and loads of enjoyable exploration. ▲

$39.99 (PC), $59.99 (360, PS3) • ESRB: (T)een
Eidos Interactive • www.tombraider.com

Let Your Moral Compass Be Your Guide—*by Dr. Malaprop*

PC Game Of The Year: **Left 4 Dead**

$59.99 (360) • ESRB: (M)ature • Microsoft • www.xbox.com/fable2

Doused With Adrenaline — *by Dr. Malaprop*

You'll discover the experience of a zombie apocalypse in Valve Software's tightly honed and polished co-op multiplayer game, Left 4 Dead. The sprinting "Infected"—the zombies—are swarming everywhere as you and your three compadres work tightly as a team to survive. The minimalistic narrative leaves much of the game background to your imagination, which works well in the scope of what's to come.

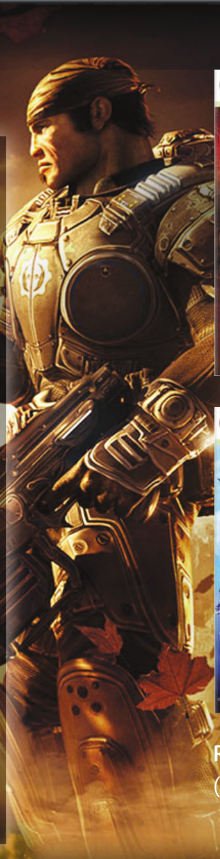
The game features Campaign, Co-op, and Versus modes. The first two modes are made up of four maps. Think of each map as its own self-sustained horror film scenario with yourself in the midst as your group makes its way to the rescue point. The Versus mode pits eight players together: four as the humans making the escape and four as specialized zombies. There are five "special infected" zombies: Boomers (spew zombie-drawing vomit onto characters), Smokers (fill a room with noxious black smoke), Hunters (draw hapless survivors away from the safety of the team), Tanks (inflicts and accepts massive damage and requires teamwork to take down), and Witches (ultra-lethal when disturbed by light or weapons fire).

Having four maps seems limiting until you see the AI Director in action. The AI feels like a person watching each game and customizing the zombie behavior so no game on a map feels the same. Left 4 Dead is a natural on the PC. It looks less impressive on the Xbox 360 but plays every bit as well. Overall, it's one of the best co-op multiplayer games in existence. ▲

$49.99 (PC); $59.99 (360) • ESRB: (M)ature
Electronic Arts • www.l4d.com

Runners-up: (1) Spore, (2) World Of Warcraft: Wrath of the Lich King.

Xbox 360 Game Of The Year: **Gears Of War 2**



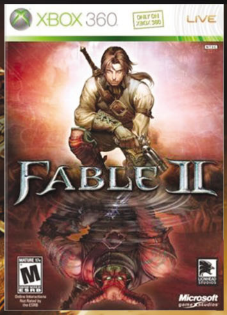
Bigger & Badder — *by Dr. Malaprop*

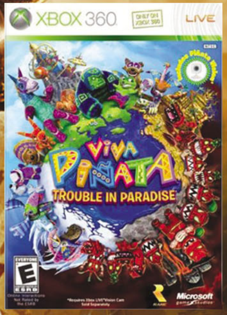
Gears Of War 2 is everything a good sequel should be. It's funny, because when you play Gears Of War 2 you think, "Yeah, this is exactly how I'd expect GoW2 to look." However, go back and play through a few levels of the original game and you'll see how significantly improved the visuals are. The story element manages to make you care about the Gears world. Though it's conclusive at the end, GoW2 leaves many new unanswered questions, which we look forward to having addressed in subsequent sequels and, perhaps, downloadable content.

The multiplayer limit has been raised to 10 players, and the maps are well suited to the increased player size. By purchasing the original game, you get a single-use download code for the five maps from the original GoW. The all-new and very challenging co-op Horde mode brings wave upon wave of enemies against your team in a very addictive arcade-style showdown that we couldn't get enough of after completing the campaign in co-op, which supports an additional player.

Understandably, the stop-and-pop cover system mechanic that GoW popularized in 2006 is no longer innovative. However, the game's focus on fine-tuning and improving its core gameplay is largely successful. At the end of the day, Gears Of War 2 is bigger, badder, bolder, and better than its predecessor in every way. ▲

$59.99 (360) • ESRB: (M)ature
Microsoft • gearsofwar.xbox.com





Runners-up: (1) Fable 2, (2) Viva Piñata

CPU Game Of The Year

Playstation 3 Game Of The Year: Metal Gear Solid 4

METAL GEAR SOLID 4
GUNS OF THE PATRIOTS TACTICAL ESPIONAGE ACTION

Cinematic Playback With Solid Snake — *by Dr. Malaprop*

You can read our full review of Metal Gear Solid 4: Guns Of The Patriots in the September 2008 issue of CPU, in which we awarded it Game Of The Month. Looking over the PlayStation 3-exclusive releases for year-end 2008, it would seem that MGS4 continues to hold up strongly.

The game is a technical tour-de-force. The animation, audio, gameplay (revamped to be stealth-action rather than stealth-only), new features (Solid Eye and OctoCamo), and all-conclusive, end-all-be-all storyline make MGS4 memorable well after its mid-2008 release. The lengthy cinema-quality cutscenes would have benefited from cinema-level editing but still enhance the story. Besides, it's a small nit to pick for an epic game that provided such a powerful single-player experience. For those with PS3s who haven't yet tried MGS4, pick up and experience the "wow" for yourself. ▲

$59.99 (PS3) • ESRB: (M)ature
Konami • www.konami.jp/mgs4

Runners-Up: (1) Little Big Planet, (2) BioShock.

Wii Game Of The Year: Boom Blox

A STEVEN SPIELBERG | EA GAME
BOOM BLOX

Throw With Gusto — *by Dr. Malaprop*

Our full review for Boom Blox can be read in the August 2008 issue of CPU. With Steven Spielberg's name associated with a game, you'd be forgiven for expecting deep emotional impact or epic combat mirroring the man's films. That's OK, because the highly addictive Boom Blox is the polar opposite and is successful for just that reason.

Post Nuclear Oblivion — by Dr. Malaprop

Boom Blox is a challenging puzzle game that can be played by all ages and is perfectly suited to the Nintendo Wii. Whether you're flinging a ball at blocks or gingerly pulling out blocks, the control feels perfectly nuanced to what you see on the screen. The Wii has legions of games that have been created around its motion-control sensibilities, but very few feel as naturally suited to the Wii as Boom Blox. ▲

$39.99 (Wii) • ESRB: (E)veryone
Electronic Arts • www.ea.com/boomblox

Runners-Up: (1) Mario Kart Wii, (2) Super Smash Bros. Brawl.

Multiplatform Game Of The Year: FarCry 2

FARCRY 2

Blood Diamonds Are A Tough Choice — *by Dr. Malaprop*

In Far Cry 2, you can play as one of nine mercenaries in a fictional open-world African nation embroiled in civil war. The day-night cycle and stunning visuals (weather, environments, etc.) preserve the sense of location. The overarching plot is to take down a notorious arms dealer known only as the Jackal, but it's the journey, with its healthy mix of stealth and action elements, that we enjoyed.

The terrain is the best "African" experience we've ever had in a game. The first time we got ourselves into some hot palaver, a friend snatched us from the jaws of death. Unfortunately, that same character was killed in the encounter. The individual missions can be completed in any number of ways. Running and gunning your way into every situation is a disservice to both your experience and the game. It looked stunning on all three platforms and is a world we want to see fleshed out in the future. ▲

$59.99 (360; PS3); $49.99 (PC)
ESRB: (M)ature • Ubisoft • www.farcry2.com

Runners-Up: (1) Fallout 3, (2) Prince Of Persia.

Grand Theft Auto IV

— by Chris Trumble

Grand Theft Auto publisher Take-Two Interactive experienced more than its share of turbulent times in 2008, as it jockeyed for position in renegotiating the contracts of key Rockstar Games personnel and fended off a takeover bid by Electronic Arts. Both issues apparently worked out the way Take-Two wanted them to, however, and of course the company enjoyed the financial benefits of yet another blockbuster GTA release.

Grand Theft Auto IV is a study in contrasts; the impressive realism and nearly flawless graphics serve to heighten the gritty, often despairingly bleak existence of its characters' lives as they lie, cheat, steal, and fight their way through the criminal underbelly of a big American city modeled after New York. The dark events that take place in the game's storyline missions are in turn frequently offset by the childlike glee brought on by accomplishing some of the series' trademark amazing driving stunts and playing the game's many minigames, and the impressive quality of the in-game music (perfect licensed tracks and surprisingly good original tracks alike) is the perfect foil for the sophomoric humor blasted over Liberty City's talk radio stations.

As we stated in our original review (July 2008 issue), however, GTA IV's crowning achievement is providing such a tight, coherent package of wildly disparate gameplay styles and experiences. The inevitable shortcoming of me-too products from other developers is that they pair some pretty good content with game elements that fall horribly short of the mark, the result of which is usually an uneven and often dissatisfying experience. GTA IV pulls off all of its various elements with style and, perhaps more importantly, segues from one experience to the next seamlessly so that your immersion in the game is never rudely interrupted while you fight with a particular control type.

And, as has been the case in the last several GTA installments, Rockstar packs so much to do and see into the game that you will tarry in Liberty City a much longer time than it would take to systematically complete the main story-related missions. Such a combination of fun and longevity is almost unheard of, regardless of game genre, and combined with the game's many more obvious qualities makes Grand Theft Auto IV a shoo-in for our 2008 Game Of The Year award. ▲

$49.99 (PC), $59.99 (X360, PS3) • ESRB: (M)ature

Rockstar Games • www.rockstargames.com/grandtheftauto

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Mnemonics For Dummies (Including Me)

Ever since writing about memory management a few issues back, I've been thinking of a related but unsung field of evergreen cutting-edge technology: human memory improvement. With the exception of a lucky few, most of us have wished at times that we could recall a lost phone number, the evasive fact we once knew that would clinch a political argument, or the name of a person we'd swear we've never seen before who is walking toward us and hailing us like an old friend.

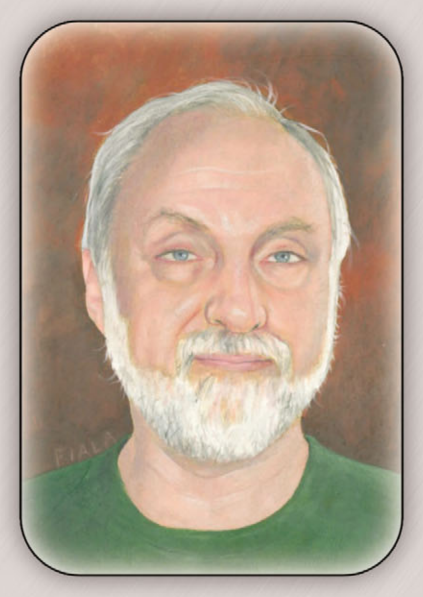
According to the Roman orator and philosopher Cicero, Simonides of Ceos invented the art of memory improvement, or mnemonics. The Greek poet included praise of Castor and Pollux in an ode honoring his host at a huge banquet, only to be tartly informed later that he'd earned just half his fee and should collect the other half from the demigods he so admired. Simonides was shortly called out of the hall to meet two people who urgently needed to see him, but when he left, the ceiling collapsed, killing all within. (His mysterious visitors were never found, but were presumably Castor and Pollux repaying their part of the debt, with compound interest.) The many bodies were so mangled that none could be properly identified until Simonides recalled who each was based on his position during the recital. From this, we are told, the poet realized that it is easier to retain facts in memory if they are stored as mental images in visualized locations.

This became what is known today as the Method of Loci. You build a memory palace in your mind, an empty edifice very carefully detailed from a view to structure, and always traveled through according to the same plan each time you enter. Then, when you need to remember something, you place an object or series of objects that encapsulate those memories at various points in your palace. During the late European Middle Ages, this became one of the cornerstones of monkish humanist training. Even that saintly Dominican, Thomas Aquinas, blessed it as a part of Prudence, one of the four cardinal virtues, and wrote that it was especially suitable for remembering and meditating on all sorts of theologically beneficial things. Mass-produced pamphlets and books on the memory palace made it a flagship of the Renaissance self-help movement, while late 16th-century Puritans predictably attacked it as evil, claiming it led to non-spiritual and even obscene images.

Another memory technique was meanwhile being developed by Aquinas' contemporary, the Secular Franciscan and missionary Ramon Lull. He invented the Lullian Circle: a complex geometric construct made up of symbol-conceived circles, triangles, and squares, interlarded with multiple rings of letters and words that could be independently moved. Lull's typically late-Medieval concept was that the superiority of Christianity to Islam and Judaism could be logically shown by mentally rotating many such Circles into thousands of configurations, which would contain the sum of all supernal truth by cross-indexing godly attributes.

None of this ended up proving anything except Lull's naivety, but two points about his Circle are worthy of note. First, there was the importance it placed on gathering, sorting, and analyzing information through primitive machine constructs. This is why Lull has sometimes been referred to as one of the earliest contributors to computational theory. Second, these same constructs also contained non-image-based mnemonics, emphasizing abstract relationships rather than objects, leading to the development of structured systems. In the short term, this meant many people would write works hijacking Lull's authorship to espouse typically complicated Renaissance occult cosmological theories. (Fans of that well-researched 1992 role-playing game, Darklands, set in a legendary version of late medieval Germany, will recall that several fanciful alchemical formulas were credited in it to one Raymond Lull.) But in the long term, it pointed the way to methods of organization that have had an impact on such fields as economics and statistics.

Next time, we'll consider some of the other early proponents of memory improvement, including one of the most flamboyant personalities of the 17th century. Assuming I can remember who it is by next month. ▲



Barry Brenesal has written more than 1,000 published articles and reviews on electronic technology since 1987. His first personal computer was a Radio Shack TRS-80 model 100. It was last seen functioning as a boat anchor.

Wax nostalgic with Barry at barry@cpumag.com

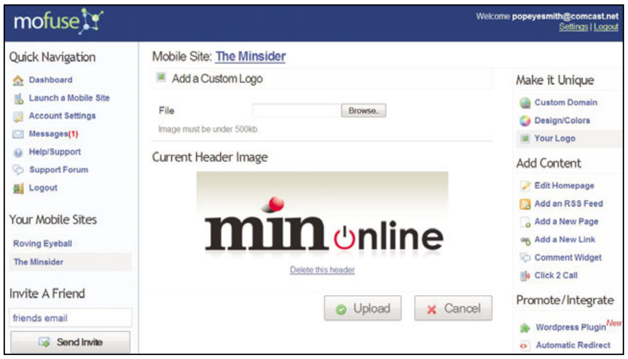
Software Tips & Projects

Blogs To Go

By 2020, mobile devices will be the primary means for accessing the Internet, according to a new study from the Pew Internet & American Life Project. We suspect that *CPU* readers are already well ahead of that curve. As smartphones proliferate, 3G networks expand, and flat-rate data plans become standard, more and more Americans use their phones to browse the Web. Isn't it time to make your Web site mobile? This month, we start exploring the free tools available to bloggers and site builders with which they can mobilize their sites.

Mobilizing Your Blog

Much like the Web log environment, several companies service the mobile Web with site-building software they offer users free in exchange for running their own mobile display ads. Some of these companies even offer revenue-sharing deals on these ads. We should remind users, however, that these are early days for the mobile Web. Many startups flood the field with unproven business models and free offers that may not stand the test of time. This is a good time to experiment but perhaps not a good time to commit to any one model or company.



The Mofuse free mobile site builder lets you turn your existing blog feed into a mobile site and then modify its look and feel for handsets.

Mofuse (www.mofuse.com)offers free mobile site creation tools, and it can be a fast track to mobilizing your blog. Once you sign up for an account, the Launch A Mobile Site button in the online interface lets you make a quick site. Simply name the site and assign it a unique URL within the mofuse.mobi domain. We decided to create a mobile portal of our own, but you can paste in your own blog's RSS feed and have a mobile version of your current Web site. When you create a site using this "dashboard" interface, you'll see a drop-down menu that has you designate a content category, which Mofuse uses to help target advertising on your free site. Agreeing to the revenue-sharing terms on this page lets ads from Google AdWords and mobile ad network AdMob run on your site.

In this initial design phase, Step 2 takes the RSS feed from your existing blog. Simply give the feed a name and paste in the URL and Mofuse will validate the feed. Don't worry about the limitations of the interface. Once you get the basic site up, the builder lets you add and edit pages later. For now, just add a feed (or check the box to skip this phase), and if you decide to agree to the terms and conditions of revenue sharing, click the bottom button to launch the site. Now, if you navigate to *yoursitename*.mofuse.mobi on your mobile browser, you'll see a rudimentary mobilized version of your blog.

Deeper Into Your Pocket

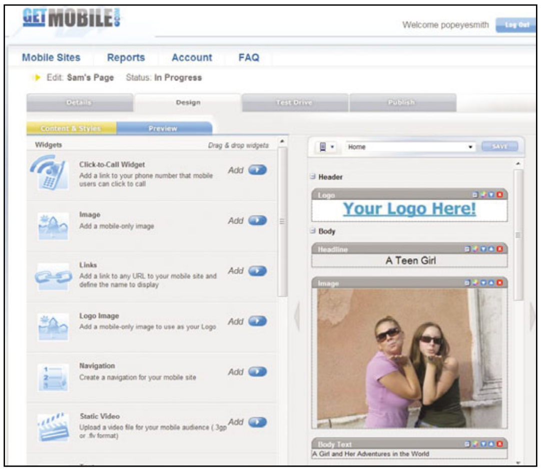
With the basic site up, you can add your own image as a logo to repeat on all pages. To do this, click the Your Logo item in the Make It Unique menu on the right-hand side of the interface. Then simply upload your image. To adjust the look of the header logo, go into the Design/Colors menu. Clicking any of the boxes here will bring up a color palette for setting overall background hues, header background, and text colors. You can center your logo here or you can elect to eliminate the logo from this specific page. If you are mobilizing a standard RSS feed, you can also modify the way the blog material is presented. In the right-hand menu, scroll down to the Your Mobile Content area and click the page with your RSS feed. In this next screen, you can designate the number of entries to include on the mobile page and also include the summary text of the most recent post.

We will let you explore Mofuse from here, but note that in the right-hand menu, you can add new pages and add Web links that Mofuse will transcode for better mobile viewing. This way, you can create your own set of mobile links on your own portal. When editing a page, we found that a phone number will automatically become a click-to-call link on some phones. We created an About Us page, for instance, and added a phone number in the text using the xxx-xxx-xxxx format. On the phones we tested, that number activated the phone's dial function.

Note that Mofuse has a plug-in for WordPress and PHP code you can drop into any Web site so that mobile browsers redirect automatically to the mobile version of your blog or site. This is a tremendous convenience for your visitors, so consult the right-hand menu in the dashboard for the various options.

DIY Mobile Portal

One of the oldest services for personal mobile site builders is mobiSiteGalore.com, which is the white-label provider behind third-party services from .mobi and others. The beauty of this service is that it doesn't run ads on your mobile site unless you add the feature yourself, and it lets you take your design off of mobi's servers and put it on your own. Once you make your account, mobiSiteGalore .com has a Quick Start wizard that lets you pick a layout and color scheme you can tweak in the next screen. We decided to make a personal portal to our own information and favorite mobile locations. Under Edit Header, for instance, you can change the topmost block of site data by uploading a logo image or simply typing in a test header. Using the Edit Title and Footer option will insert the title of the site that appears on the top of your browser and the copyright info at bottom of the home page.



GetMobile.com can help you build mobile Web sites or even transcode an existing site that you can modify here for mobile use.

Click Next to construct the basic architecture of additional site pages, each of which will be a navigation link from your front page. In the left window, simply highlight the page name you want and click the slot in the right window where you want it placed. On our test site, we used Favorite Links, Contact Me, and Gallery for the personal page. Clicking Next will give you a preview of the basic design, and choosing Accept Changes moves you into more detailed editing. In the next window, you'll get a full design suite and a WYSIWYG editor within a phone. Simply click inside the colored text boxes beneath each of your main page links to describe the section. You should see an index of your main pages in a column to the left of the handset emulator.

The interface gets a bit obtuse here. You need to complete the content entries on the Home page and then click Submit Changes in order to advance to editing the next page in the design—in our case, Favorite Links. In this next page, we created a mobile portal for ourselves. In the Headline 1 box, for instance, we titled a link Mobile Links, and in the text box beneath it, we used the Link icon in the top interface to open the Edit Link dialog. We could create links back to other pages in the mobile site, to files we might upload to the site, or to a Web address or email address. We opted for a Web address and used the m.cnn.com address for CNN's mobile Web site. In the text box, you can enter a carriage return and click the Link button again to add another link, such as weather.mobi. You can repeat this to make your own mobile portal site.

We will return to this process in greater depth next month. For now, once you finish all of your pages, mobiSiteGalore.com gives you the option to let it host the site within its own "param.mobi" domain free. ▲

by Steve Smith

Windows Tip Of The Month

Rumor has it that the Windows Vista firewall not only blocks suspicious inbound intrusions but is also capable of blocking outbound violations of security protocol. The problem is that by default, Vista does not enable the outbound monitor. To turn it on, type **firewall** in the Start Search box and choose Firewall With Advanced Security. In the main pane of the next window, choose Windows Firewall Properties. You will find the drop-down for Outbound Connections, which you can set to Block. You can see the Outbound Rules governing the firewall in the previous window and use the New Rule command on the right side of the window to add permitted programs.

Registry Tip Of The Month

Security-conscious PC owners should realize that their USB ports are one of the most vulnerable ports of entry for snoops. If your PC is on, any passerby with a USB storage device can pop it into the slot and copy documents off of your PC at will. Use this quick Registry hack to block any writing of files to a USB port. In Regedit, go to HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control and right-click to make a New/Key. Name the key StorageDeviceProperties and right click it to make a New/DWORD named WriteProtect. Double-click this new Value and set the value to 1 to enable write protection of any USB device. Set it back to 0 to disable the protection. The effect is immediate on any new device you plug in subsequent to making the change. Keep in mind, however, that this setting affects all writing to all USB devices, including any external hard drives you may have connected.

Infinite Loop

Pulling Water Out Of Thin Air

Remember those 'vaporators from the Star Wars movies? Well, now you can have your own. A new device called the WaterMill extracts clean drinking water from the air, up to 13 quarts per day. The WaterMill isn't cheap, but it's certainly a cool concept that we'll raise our glass to.

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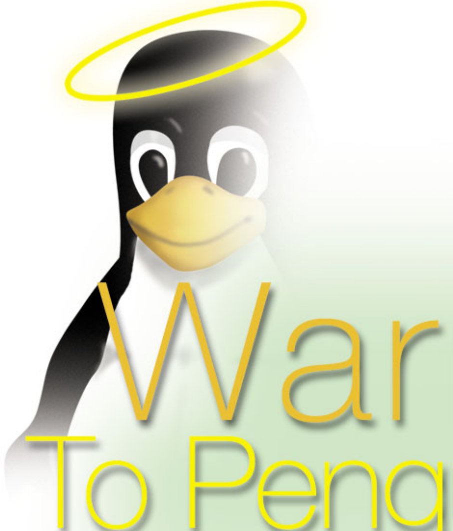


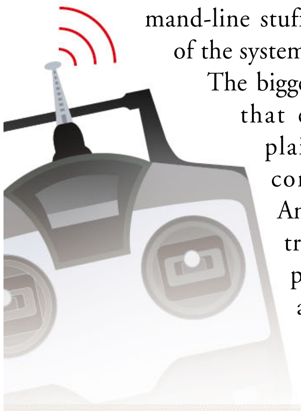
Warm Up To Penguins

Remote Controlling Linux

Many Windows users are familiar with the Remote Desktop setting, which lets them access their systems remotely. Remote Desktop gives access to the entire Windows GUI, so you can use your system as though you were in front of it.

As useful as Remote Desktop is, it has some notable drawbacks. One of the biggest problems is that you need a graphical display for access, so text-only devices, such as some cell phones, can't be used. Another problem is that Remote Desktop only lets one user use the system at a time.

There are a number of approaches to remotely access your Linux machine. Not all are graphical in nature, but all allow multiple remote users to log in at the same time. One of the most well-known methods of remotely accessing a Linux system is the telnet command. This command connects to a Linux box, letting you do all the command-line stuff as if you were in front of the system.



The biggest problem with telnet is that everything happens in plaintext, so everything is completely unencrypted. Anybody watching network traffic can see usernames, passwords, commands, and anything else during a telnet session—not a good thing.

A Little Security, Please

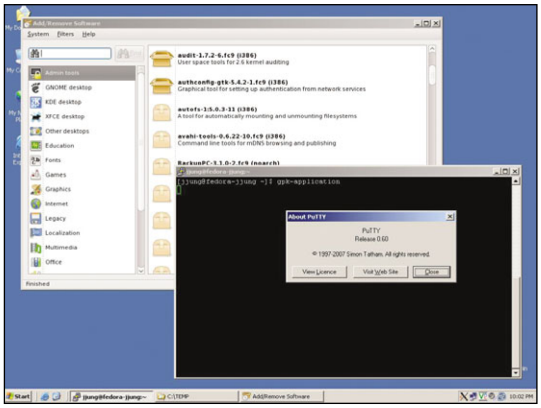
A replacement for telnet was developed known as SSH (Secure Shell), which encrypts the entire connection. In order to access a system with SSH, you'll need to have an SSH client and server. The SSH server needs to be installed and running on the system you want to remotely access. Fortunately, because a lot of people want to remotely access their Linux systems, the server is readily available on many Linux distributions. And in a lot of cases, once you've installed the appropriate package and enabled the SSH service, you're good to go. For Ubuntu, you'll need to run the Synaptic Package Manager and install the openssh-server package. openSUSE users will have to go into YaST and install the yast2-sshd package. As for Fedora, click System, Administration, and Services, and then enable sshd.

All Linux systems come with an SSH client, called ssh, which you run from the command line. To log in to an SSH-enabled server, open a terminal window and type ssh -l remoteuser remotehost, where "remoteuser" is the username you want to use to log in and "remotehost" is the name of the remote machine you're accessing. Enter the password for remoteuser, and you'll be logged in to the remote machine. Although this might not sound like much, you can do a lot of stuff from the command line in Linux. For example, you can edit text files (using vi or emacs), check what's running on the system (ps), or stop any running applications (kill).

But if you absolutely must have access to graphics, you can specify the -Y switch right before the -l switch shown above. With that, any command you run from the ssh session that uses a GUI will appear graphically on your system. But for -Y to work, you need an X Windows server running on your machine. Thankfully, almost all Unix distributions will have X Windows running by default. Be advised that X Windows is a very chatty program, so don't specify -Y if you're on a low bandwidth connection. But if you're doing stuff that absolutely needs graphics and you have the connectivity, then go for it.

Tools Beyond SSH

If you're on a Windows machine and need to log in to a Linux system remotely, don't worry. There's a widely used open-source SSH client for Windows known as PuTTY. One of PuTTY's niftiest features is that it will display X Windows applications on your Windows system. For this feature to work, you must be running an X Windows server on your Windows box. There are a number of commercial X Windows servers for Windows, but a good free one is Xming.



audit-1.7.2-6.fc9 (i386)
User space tools for 2.6 kernel auditing

authconfig-gtk-5.4.2-1.fc9 (i386)
Graphical tool for setting up authentication from network services

autofs-1:5.0.3-11 (i386)
A tool for automatically mounting and unmounting filesystems

avahi-tools-0.6.22-10.fc9 (i386)
Command line tools for mDNS browsing and publishing

BackupPC-3.1.0-2.fc9 (noarch)

```
[jjung@fedora-jjung ~]$ gpk-application
```

PuTTY
Release 0.60
© 1997-2007 Simon Tatham. All rights reserved.

Fear not, Windows users. PuTTY lets you connect your Windows box to a Linux system.

If you're looking for a cross-platform remote management package with graphics capability, there's the open-source program

VNC (Virtual Network Computing). VNC was developed in the early 2000s to provide easy access to remote machines without a lot of network bandwidth. Since then, VNC and its associated RFB (remote frame buffer) protocol have come to dominate the open-source remote desktop software. VNC runs on Linux and Windows with Mac support on high-end commercial implementations.

VNC is preinstalled on many Linux distributions; it's just disabled by default. To enable it in Ubuntu, click System, Preferences, and Remote Desktop, and then enable the Allow Other Users To View Your Desktop option. You can optionally prompt to accept remote connections and require a password. Fedora users can enable remote VNC access by clicking System, Preferences, Internet And Network, and Remote Desktop. For users running GNOME on openSUSE, click Applications, System, and Remote Desktop.

openSUSE users who use KDE as their desktop have a different way of allowing VNC access. They need to click the SUSE icon and then click Applications, System, Remote Access, and Desktop Sharing. A gray icon appears in the toolbar; when you right-click to restore it, you can configure it in a number of ways. You can invite people to connect or grant permission to users who have not been explicitly invited to connect and take over your machine. When someone connects to your system, you'll be asked if you want them to control your system and allow or deny the connection entirely.

Once the host system is set up to accept VNC connections, you're going to need something to connect to it. One of the best programs to talk to a VNC system is Terminal Server Client. It not only lets you connect to a running VNC box but also connects to Windows systems with Remote Desktop access enabled. This is possible because it understands the RDP (Remote Desktop Protocol) that Windows Remote Desktop uses.

Fedora doesn't have Terminal Server Client installed by default, so you'll need to install the tsclient package. Once installed, click Applications, Internet, and Terminal Server Client to launch the program. Ubuntu does have this client installed out of the box. You can run it by clicking Applications, Internet, and Terminal Server Client. Its VNC capabilities aren't enabled, so you'll have to install the xtightvncviewer package. openSUSE users will need to install the tsclient package before the client will show up (under Applications, System, Remote Access).

With Linux's Remote Desktop option, it behaves similarly to the Windows Remote Desktop feature. Only one user can access the desktop at a time, whether they're in person or remote. When a remote user connects to your system in this manner, you'll get an alert saying someone else is controlling the desktop. One notable difference with the Linux Remote Desktop features is that a user must be logged in for it to work. Although some may consider this a drawback, it's actually one of the stronger features with VNC.

The Remote Desktop feature we've described so far is actually a specialized version of VNC. There's a much more general version of VNC that's much more powerful known simply by its name: vncserver. The biggest difference between vncserver and Linux's Remote Desktop is that you can run multiple vncservers simultaneously. To do this, however, you have to make sure that you have the vncserver package installed on your system. Fedora users will need to install the vncserver package, while Ubuntu users will need the tightvncserver packages. Happily, openSUSE users won't have to do anything, because it's already installed out of the box.

Once you install vncserver, the only thing you have to do to run it is open a terminal window and type vncserver. The first time you run it, you'll be asked to specify the password needed to connect to the server. After that, you can connect to it like you would connect to Linux's Remote Desktop system.

So how is this more powerful? For the average home user, this probably doesn't buy you much, but for the office environment, you will now be able to remotely manage Linux boxes while other people are still using them. Unlike Windows, where only one person can have a GUI desktop at a time, with vncserver, this limitation is removed. The end user can continue to use the system while you remotely do your work, and nobody is interrupted. The local user can even completely log out of Linux without affecting your VNC session.

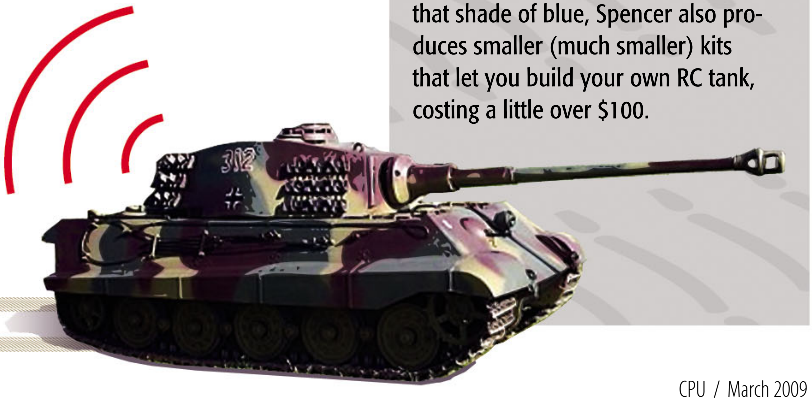
No matter how far away a Linux machine is, you can still remotely control it. Whether you need plaintext commands or a full GUI suite, ssh and VNC give you lots of options. ▲

by John Jung

Infinite Loop

RC Tank Pulls Cars, Crushes Your Wallet

Tipping the scales at a stout 250kg and capable of towing a car on a level surface, Mark Spencer's remote-controlled, quarter-scale King Tiger replica is the ultimate "toy" for the 30-something child at heart in your life. The tank includes a 2-foot long gun, complete with recoil action (to answer your immediate question, it's not fully functional). But the best news is that Spencer's willing to build you your very own RC King Tiger if you can cough up roughly $14,400. Of course, if your blood isn't quite that shade of blue, Spencer also produces smaller (much smaller) kits that let you build your own RC tank, costing a little over $100.



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Shavings From The Rumour Mill

by Mike Magee

PC Industry Will Weather The Storm

As I write this, the semiconductor market is in total turmoil because of last year's credit crunch. It's not that no one needs chips; every forecast says the chip industry will continue to do well. It's just fear.

Everyone is hunkering down, and the word on the street is that orders for chips are way, way down in what's usually the most buoyant period. Mighty Intel and just-as-mighty Texas Instruments have issued profit warnings, but we have to remember that these days, chips are omnipresent.

For example, the automotive industry relies heavily on semiconductors in all sorts of ways, be they controller chips for the engines or processors that control the dashboard. Big automotive firms, such as Toyota, have just released results that show their worst output record since 1941, the year of Pearl Harbor. No one is buying anything, and it's my feeling the fallout will continue in 2009.

How will this affect the PC industry? The roadmaps are already out there, and we will see giants like Intel continuing to roll out new processes, with faster and smaller chips. But if no one is buying PCs out of economic fear, Intel customers like HP and Dell will be hesitant to commit too far in advance with large orders, based on normally cyclic patterns.

It is a matter of weathering the storm. Companies like Intel, HP, and Dell will not go away. Although all three companies likely suffered from the same market-driven problems that plagued every company in late 2008, they still have cash. I've written about Intel since 1986—just a few years after the first IBM PC came to be—and there have been two periods of recession since then. On each occasion, Intel lashed itself to the mast, made the cuts it needed to make, and weathered the storm successfully.

There's no doubt the big companies will survive, but my real concern is for the smaller players that rely on the Wintel alliance, be they LCD manufacturers; makers of DRAM; or the small firms no one ever hears about who make connectors, resistors, and capacitors, and so on.

While there will undoubtedly be bargains for everyone this year, those bargains come at a real cost for our future. If no one is buying anything at all, the bottom line is that funds for research and development will be cut. That is not good news. We are close to the time when the long-awaited dream of communications and PCs converging is finally coming to pass. But this depends on the whole industry working together, which in turn relies on people such as software engineers, CPU architects, and telecom companies continuing to stick to their last.

While the current economic woes may continue for quite some time, I don't believe that the community will give up and leave us stuck with old technology. Lesser players may fall out of the picture, which is a crying shame, but the world will continue to revolve, and the PC industry will carry on evolving.

This time last year, the manufacturers were pumping out highly expensive graphics cards that were clearly not worth it. DRAM manufacturers were adding "features" that added nothing to your system apart from brightly flashing lights to see in your transparent PC chassis, and it seemed the sky was the limit.

This year will see a series of announcements from PC manufacturers that incorporate, to me, exciting new developments. They include faster and cooler microprocessors, solid-state hard drives that finally fulfill the promise of your PC booting almost instantly, and telecom features built into chipsets so that you can connect without breaking the bank.

We will also see a big consolidation in the industry, and that can only be good. For the last six years, vendors have gotten away with murder and charged too much for what was essentially too little. That has changed already, and now it's what buyers demand that's important and not the features manufacturers choose to foist on us. ▲

Mike Magee is an industry veteran. He cut his teeth on ancient products like the Dragon and the Japanese PC platforms long before the IBM-PC won. He worked for a corporate reseller in the mid-'80s and saw the Compaq 386 sandwich box and every GUI known to humankind. Mike decided that the way to go was the Interweb around 1994 after editing PC mags in the late '80s and '90s. A co-founder of The Register, Mike started the chip-driven INQUIRER (www.theinquirer.net) in 2001. He has contacts from top to bottom in the business, spanning the entire chain, who help him root out interesting rumours and speculation.

Send rumours to "Mad Mike" Magee at mike@cpumag.com

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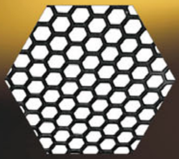
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Wagging The Dog

by Rahul Sood

The Console As You Know It Is Doomed

Last month in this space, I wrote about how I believe the gaming PC (or high-performance PC) as you know it is dead, and I received a number of emails in response. I want to be clear about something; in no way was I implying that PC gaming is dead—I was referring to the binge-and-gorge hardware selections pushed by hardware manufacturers and system builders alike. The bottom line is people are demanding a heck of a lot more for a heck of a lot less, and though there is still a market for premium PCs, the systems of the future will be far more efficient, as will the hybrid vehicles of the future.

The gaming PC will live on, and as content distribution continues to move online, we're likely to see the PC remain the king of all platforms when it comes to gaming.

That said, this month I'm going to adjust the subject slightly. The gaming console as you know it is doomed, too.

I simply cannot see the current console business model living through another refresh. Though Microsoft is doing everything it can to link the PC and console gaming communities together via its Live online service, Sony seems to be having a tough time competing, even as its hardware costs have begun to come down. There are currently two distinct models in the console market: the one that Sony and Microsoft followed (the traditional console model) and one that Nintendo created.

Nintendo is cleaning up; the Wii and the DS are fantastic devices. Not only did Nintendo succeed in bringing more people into the living room to play games, but it also created a piece of hardware that it can make money on. By now the cat is out of the bag that Nintendo is making a healthy margin on its hardware, developer licensing, and accessories, both first- and third-party. The DS has been embraced by young and old, thanks to some simple yet incredible content. Its game attach rate is enviable in what seems to be a very competitive industry, but in reality there is very little competition in the core handheld gaming space.

Sony and Microsoft are both still losing large chunks of money on their hardware. There is no way around this, as they chose to go down a path in which they lose money on each console sold in hopes that a combination of licensing, game revenues, time, and scale would help them become profitable. Sony gambled on Blu-ray, and although it is a great format, the costs are far too high for the average person, who in many cases isn't looking for a high-def movie player to go with his old-school television. The PS3 guys banked on the fact that those who want a Blu-ray player will likely opt for a PS3 instead—and this makes sense, except Sony also launched Blu-ray players for much less money, which basically kills the "PS3 proliferation through Blu-ray" strategy.

Microsoft seems to have a better chance of success at this point because it has a strong foothold in the PC space and is actively working to link their communities together. Microsoft has also automatically created extender services for PCs into the living room via the Xbox. It's hard to say where this might lead in the future, but you can bet Microsoft will leverage whatever areas it can to help increase its distribution. Right now, both the Sony and Microsoft business models are deeply flawed, and in my opinion they will be forced to adjust.

In any event, corporate operating expenses are gold at the moment, and it's not a good time for big companies to experiment with risky business models. That does not mean innovation should die—quite the contrary—but they must ensure that they create profitable products with no-strings-attached business models. My guess is after this run, the console will never be the same. Nintendo's Apple-esque model of raking in large margins on its hardware while creating a common ecosystem will likely make would-be competitors rethink their approaches.

So, as is the case with PC gaming, console gaming may survive, but I guarantee you the typical console business model of today is pretty much dead. Now flame away. ▲

Rahul Sood's love for computers started at the young age of 11. Much to the shock and dismay of his parents, he ripped apart his brand-new Apple //c and painted it red before turning it on. His parents' dreams of having a doctor for a son were shattered when college drop-out Rahul founded what is now one of the most respected high-end computer companies in the world, Voodoo Computers.

Send your opinions to this opinionated guy at rahul@cpumag.com

Technically Speaking

An Interview With Justine Cassell, Director, Center For Technology & Social Behavior

Justine Cassell is the director of the Center for Technology and Social Behavior, and a full professor in the departments of Communications Studies and Electrical Engineering & Computer Science at Northwestern University. She is also the graduate director of the new Technology and Social Behavior joint PhD in communication and computer science. She holds a master's degree in literature from the Université de Besancon, France, a master's degree in linguistics from the University of Edinburgh, Scotland, and a double PhD from the University of Chicago in psychology and linguistics.

by Barry Brenesal

CPU: As the co-editor of the book "From Barbie to Mortal Kombat," is it fair to state that the whole question of computer games created specifically for girls is informed by culture stereotypes? If not, then in your opinion how do we distinguish between games for girls and those for boys?

Cassell: First of all, it's important to keep in mind that the very notion of computer games for girls is a relatively recent one. Until probably a decade ago, the idea that computer games would be created for girls—or just for boys—was really foreign to game design. Two forces came together to bring about the idea that there needed to be and could be computer games for girls. One of these was that tech companies were struggling. They had lived through an era of relative wealth, and sales were in a decline. In their search to bring their numbers back up, it occurred to them that only 50% of the potential audience was buying their games. Market studies they carried out allowed them to realize that their games just weren't being bought by girls.

And this came as a surprise to them. I don't think they had ever really thought about it, or if they did, I don't think they had ever worried about it. They had assumed up until then that girls were not interested, and this was the issue. In fact, one computer game executive told us, and we quoted her in our book, "I'll make computer games for girls when girls are interested in computer games."

At roughly the same time, feminist scholars and activists became aware of the same fact—that computer games were not being played by girls. Rather than seeing this as a market issue, they saw it as a potential explanation of the statistics that were so often cited by the mid-1990s: that the number of girls going into computer science were so much smaller than the number of boys; and, in some senses even worse, girls dropped out in every single level of computer science far more than boys.

I did mention there were two forces, but there was also a brand-new group of female entrepreneurs coming to the fore. Women were starting businesses at twice the rate of men, and they were doing well. Feminists concluded that boys entered the computer science field because they were playing computer games early. This led game companies to decide that if they could make games with broader appeal, perhaps they'd sell more. And it was causing female entrepreneurs to think that this was a market venture for them. It was really the first time that anybody thought of computer games for girls. Now, that very fact makes it suspicious, because what it means is that before then, games companies simply saw themselves as making computer games for game players. It just happened to be the case that game players were boys.

CPU: So when Johan Huizinga defined Homo Ludens as humans at play, did he get it wrong, overlooking the fact that girls play less than boys?

Cassell: No, not at all. In fact, all of the statistics showed—and this is why it was seen as a way of getting girls into computer science—that yes, it was true games were played more by boys than by girls. In fact, computers were used more by boys than by girls. Except that, when you put the same number of computers in a room as children, all the children used them equally. When you put in five computers and there were 10 children, five girls and five boys, it was the boys who used them.

CPU: So we're actually talking about nurture vs. nature.

Cassell: Exactly. And I've had parents say to me, even just recently, "Why would I be upset if my daughter isn't playing computer games? I'm kind of relieved she's the only kid in my household who doesn't have a Nintendo in use all the time. It's just a question of interest: Boys like it, girls don't. What's wrong with that?"

> It's just a question of interest: Boys like it, girls don't. What's wrong with that?
>
> —Justine Cassell

There's a lovely study that we quote in the first chapter of "From Barbie to Mortal Kombat." Computer game designers were asked to design games for boys, and then they were asked to design games for girls. Then, they were asked to design games for students. The games for students and those for boys were identical. This is just another way of noting that when computer games companies were going around saying, "No, we were going around designing games for everybody, and girls just weren't interested," they were probably designing games for people like themselves, who were, in those days, primarily men.

CPU: But you noted that in the mid-'90s, this started to change.

Cassell: In 1995 and 1996 a slew of new games companies started to build computer games for girls—perhaps, most famously, Purple Moon, directed by Brenda Laurel, a very famous scholar in virtual reality and new media who had been at the Interval Research Corporation before starting her company, and Theresa Duncan, who did some beautiful games first at Magnet Interactive and later at Nicholson NY. Then the game companies starting spinning off a kind of skunkworks to build games for girls. Mattel made the first big hit, with Barbie Fashion Designer—which happens to be a game I love, because it hit upon a really interesting device that occurs partly on the computer, but partly through craft. That is, you design clothing printed on fabric, using a regular printer, then you cut it out and sew it. The game initially sold more copies than Mortal Kombat.

In any case, all of these companies were launched. Some of them thrived, and most of them failed. Ultimately, all of them failed. The game companies adopted what is often called an essentialist discourse about girls. They went around saying, "Girls, girls, what do girls like? They like…pink! And lipstick." They built games that were about dressing up, and telling secrets, and most of them pretty much bombed. Or as the girls told us, "What made these companies think that just because we don't like shoot-em-ups, we don't like action?"

But the games companies are pretty happy; for example, Electronic Arts did well from the get-go with The Sims—and that was never intended to be a game just for girls. Will Wright set about to build a new kind of game. He's put some effort into gender balancing it. He's hired a lot of women. He's made sure they think carefully about stereotypes as they build their games. His games are attractive to girls, but there is no evidence that shows that these computer games, whether girls like them or not, are leading girls into computer science.

In fact, in recent years the numbers of women entering computer science have actually gone down. How can it be, when so much effort has been made to get girls playing games, that girls still aren't going into computer science? In fact, just to make the story even more complicated, girls are playing a lot more computer games today than they were 10 years ago.

CPU: Do you think that the pop culture image of the computer science professional as a gangling, intelligent, but socially inept person who wears a pocket protector contributes to this?

Cassell: That has been one of the hypotheses that's been put forward, and I personally think that's part of it. But it's a little bit more complicated. I believe it has to do with stereotypes of what it means to be a computer scientist and the stereotype of what it means to be a girl and the fact that those stereotypes have hardly any intersection. I had an undergraduate tell me that she wanted a job in my lab and that I shouldn't worry about her computer skills because she wasn't a normal girl.

What that tells you is she felt the need to mark her distance from "regular girlhood" as a way of marking her proximity to "regular computer sciencehood." I think that's the dilemma that we're still facing. The stereotype of what it takes to be a girl has a lot of features in it that are antithetical to what it takes to be a computer scientist. The effects of that stereotype are ubiquitous—and the reason I think that's the case is because if you look at non-game computer activities, girls are on the computer all the time. They're instant messaging. They're using Facebook. They're blogging. They're really Web 2.0 superusers. Yet they don't think of themselves as expert users. CPU

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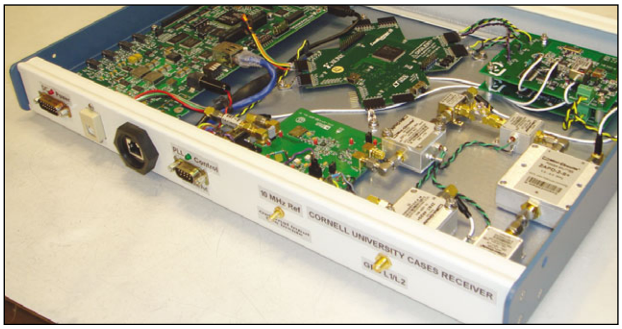
By Anastasia Poland

Under Development

A Peek At What's Brewing In The Laboratory

Duping GPS Devices "All Too Easy"

Although many of us don't realize it, GPS technology has become ubiquitous in our lives. No longer just the cool toy of cutting-edge backpacking enthusiasts, high-end vehicle owners, or treasure-hunting geeks, GPS is often used to synchronize power stations, monitor house arrests, and coordinate military operations and marine traffic. More than 30 U.S. satellites orbit the Earth twice daily, feeding signals to receivers and delivering the coordinates of their locations. Now three Cornell professors have rather inadvertently discovered how quickly those signals can be interrupted.



Cornell researchers have shown that a GPS receiver can easily be used to attack other GPS devices and falsify their signals.

Paul Kintner, Todd Humphreys, and Mark Psiaki were originally developing a suitcase-sized GPS software receiver for use in ionospheric research (to study how they are vulnerable to space weather) when it occurred to them that the receiver could easily be converted to a "spoofer."

"Spoofing means to redirect a GPS receiver without the receiver recognizing that it is being attacked," explains Kintner, the director of Cornell's GPS Laboratory. "An analogy [using] time is to reset your watch without your realizing that the time has changed. Generally this means replacing the real GPS signals with identical, but fake, replicas, then slowly changing the replicas to some other location."

And that's exactly what they did. The professors used the software receiver's digital signal-processing chip to re-create the signals it was receiving and then redirected them to another receiver, essentially "attacking" it by methodically falsifying those signals to read as a different position.

The only challenge that the team members encountered with developing their spoofer was that they had no funding, and the work had to be done in their spare time. What is disconcerting about the discovery is that Kintner, Humphreys, and Psiaki accomplished the task in a mere two-week time span, according to Kintner. "It is all too easy," Kintner says, adding he suspects that within five years or so, technology will be such that anyone with a modicum of engineering prowess will be able to create a homegrown spoofer.

The point of the team conducting and presenting the research was not to further future development of detectors or spoof-proof receivers. Instead, they wanted to send a wake-up call to both industry and government as to how simple it is to fool the systems we've come to rely so heavily upon. ▲

Data Hounds: New Software Changes The Face Of Search

Even the best search engines can't extract information presented in an image. Nontextual information is basically unsearchable for content. But the work of two Penn State professors has helped make one type of nontextual search—databases and graphs—more accessible.

Professors Lee Giles and Prasenjit Mitra are the leaders of Penn State's ChemXSeer project, a "cyber infrastructure" they're building to provide chemists "with a site where they can store their data and scholarly articles, link their information with our repository that hosts other datasets and articles," explains Mitra. ChemXSeer is more than just a collaborative database, however. The Penn State team is creating a toolset (some are already in use) for the database that will augment and change search as we currently know it. The following new technology is a sample of ChemXSeer:

TableSearch. This lets users search for tables (using criteria such as type of experiment, type of reaction, experimental conditions, and materials used) in articles across the database.

FigureSearch. FigureSearch crawls 2D graphs and "reverse-engineers the plot to extract the legend, captions, references to the figure in the text, and data points and lines in the 2D plot," and then delivers data in a table.

FormulaSearch. This tags and delivers, with 92% contextual accuracy, chemical names and formulae. In other words, it can tell the difference between "OH" as a reference to Ohio and the hydroxyl ion.

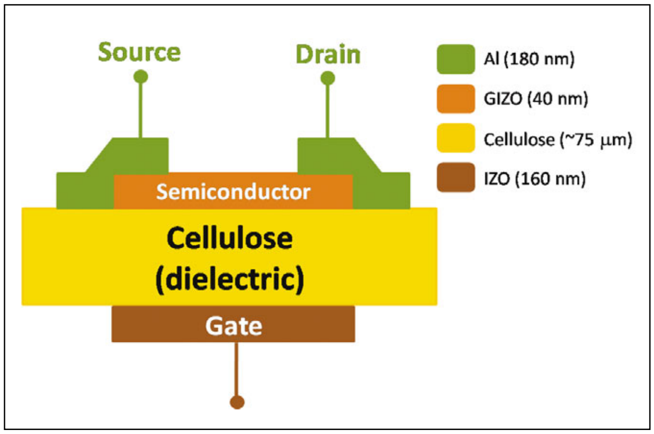
StructureSearch. With StructureSearch, a user can draw a chemical structure and submit to the chemical structure database, and matching papers and data are retrieved.

Integrated data-document library. By using this, raw experimental data submitted to the system is linked to papers that discuss the data. The system creates digital objects, such as graphs or models (like the structure of a chemical compound) for review. ▲

The Road To Disposable Electronics May Be Paved With Paper

Breakthrough research conducted by the New University of Lisbon's Dr. Elvira Fortunato and her fellow professors has taken simplicity to new heights in developing inexpensive field-effect transistors. Eschewing more complicated and typical materials such as silicon, Fortunato and her team turned toward one of the most common organic materials in the world—paper—to find it was both an environmentally friendly and low-cost alternative in creating transistors.

They wanted to use a material that was "so common as to add value for the future, such as the creation of active paper electronics," where data can be gathered, transferred, and then disposed of, says Fortunato. Possible practical applications for such transistors include microelectronics, biosensors, or RFID tags that are built into paper labels of products.



Simple cellulose paper has proven to be an excellent choice for materials in new transistors.

What's exciting about Fortunato's research is that paper has a dual purpose in the transistor's construction. Typical transistors (and Fortunato's) have three terminals (source, drain, and gate) and switch either on or off. The terminals are made of three types of materials—conducting, semiconducting, and insulating, respectively.

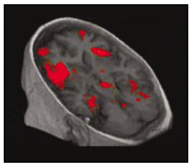
"We used the [conventional paper] simultaneously as the physical support for the transistor constituents and also as the dielectric (insulator) material of the transistor," explains Fortunato. "We used the insulating properties of the cellulose paper to fabricate the insulator layer of the transistor, through which charges are induced to modulate the channel, changing its state from a non-conducting to a conducting state."

In other words, by simply covering both sides of the paper with metal oxides (which can be processed at room temperature), then attaching the terminals (aluminum contacts) to the paper, the team had everything needed to conduct electricity through the transistor. Tested over the course of two months with no failure, the paper transistors seem to have a bright future.

Fortunato's team has also created a memory circuit from paper that is capable of storing, displaying, and deleting information. Although Fortunato and her team have no timeline in place to market their transistors, they have contacted companies interested in the technology. ▲

Computer Model Helps Unravel Brain's Perceptions

How we perceive and process objects has long been a mystery, one that researchers involved in the study of neurological problems would dearly like to solve. With the advance of fMRI (functional Magnetic Resonance Imaging), the study of the brain has become much easier, and new vistas have opened up for researchers. And now, with a new computer modeling program crafted by a team led by Carnegie Mellon's Tom Mitchell (computer scientist and chair of the Machine Learning department), Marcel Just (neuroscientist and director of the Center for Cognitive Brain Imaging), it may be possible to deeply investigate the differences in perception between a typical brain and one with autism, aphasia, dyslexia, or Alzheimer's, for example.



Carnegie Mellon scientists are utilizing fMRI images in their computer modeling program to help understand language comprehension.

The team used fMRI technology to observe neural activity in subjects' brains while the subjects were viewing either an image or a word of a particular object. The computer model then was trained to classify these brain images according to the typical neural activity associated with the objects. The model was able to identify with 90% accuracy what category an image's activity fell into. For instance, the team showed subjects words and images representing tools and ones representing buildings. Whether in word or picture form, the model was able to suss out the brain images and classify them correctly.

The model then was able to take identification one step further by predicting the category or exact stimulus of the brain images not yet programmed into its database and then recognize, with 78% accuracy, the actual images when presented. The team is starting to work on collecting data for words beyond just concrete nouns. They are looking at abstract concepts (such as "love" or "democracy") and phrases.

Mitchell and Just's research will hopefully someday help us understand how the brain processes language concepts (a feat in itself)—so that we then better understand an atypical brain's deviation from the norm. ▲

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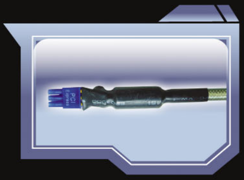

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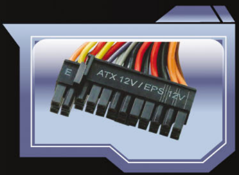

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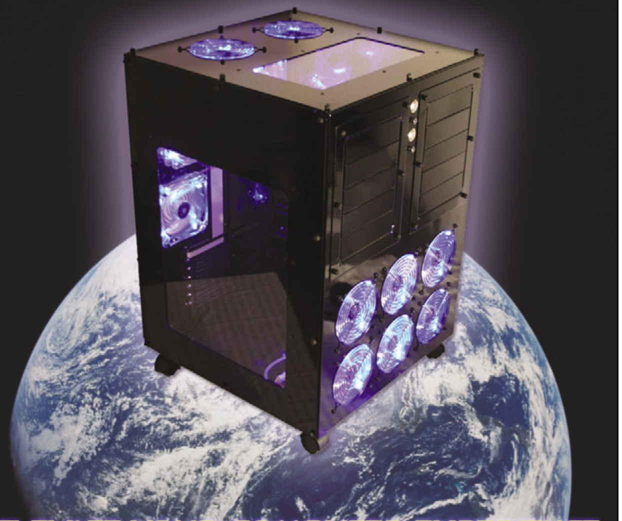

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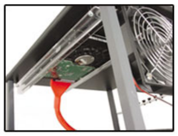

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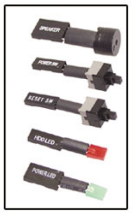

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Q&A With Henry Tirri

The world's largest maker of cell phones has a vested interest in keeping innovation going in mobile technology. That's why Finland's Nokia has more than 700 researchers worldwide working on next-generation mobile technology. Henry Tirri, senior vice president and head of Nokia Research Center, is the man charged with directing those researchers. He recently opened a new office in Los Angeles to keep Nokia at the forefront of mobile entertainment. Tirri talked about everything from "augmented reality" to improved traffic navigation.

Q So the mobile world is opening up. Nokia itself is becoming more open, and consequently your research is more open now. Is that right?

HT I would say these openings are aligned. They are not causes of each other. Research on the top level has to have open components. I talked to Rick Rashid, head of Microsoft Research. We agreed that if you take any top research group and put it in a closed environment, it will not be a top research group within five years. Openness is a necessity for research. It's also an impact of the ecosystem, or platform. To have an innovation platform, you need openness. Nokia has moved toward openness by acquiring Symbian (maker of cell phone operating systems) and making its work available as open source.

Q Are there some big milestones in the history of the smartening of smartphones?

HT For me, the phone should not itself be viewed as smart. The handset is doing more things. It is interconnected. Some people consider phones to be smartphones if they can access the Internet. To me, that's straightforward. That's not enough. Using a phone as a way to access the Internet is not by itself important. What you need in a phone is context. That context awareness can deliver useful information to you when you need it. To me, the smartphone can provide smart context and seamless access to the digital information that we have. That's how I view smartness.

Q Is that replicating a computer on the phone?

HT It's going much beyond a computer in the phone. When you think about context of a mobile device, it should know where you are. It should know what you're interacting with. It should know your calendar and where you need to be. It should be able to sense the environment around you. That's a computer on steroids.

Q Do you agree with this idea that mobile technology is driving Silicon Valley?

HT In the time I have been here, it has changed. In the past, Europe drove it and the Valley was behind. I've talked with a bunch of CEOs here. Every single venture capitalist I've talked to has discovered that every one of their companies needs to come up with some kind of mobile solution.

Q What are lessons of Apple's success in mobile phones?

HT Apple has evangelized this new kind of data-driven phone. . . . Before the iPhone, people didn't understand that you could have software running on a mobile device. People didn't get it. Also, Apple has impacted the ecosystem of developers. A startup has a chance to take anything that runs on the Internet and [move] it to the mobile space. They can launch it and get $1. That's not so great on the PC. But on the handset, the numbers look very attractive. Apple has done tremendous ecosystem work that will benefit the whole industry.

Q Is there a time when you expect mobile payments to work worldwide?

HT It's a reality in Japan. We have Near Field Communications, which let you purchase something that is inches away from the phone.

Q Let's talk about augmented reality, which blends real camera data with information on the phone. What's your favorite example of that?

HT It would have to do with travel or tourism. You point your camera at something and then you can get information about what you're pointing at. Also, games would be very fun. You can have special glasses maybe and you can see aliens coming at you from a particular landmark. You see the world differently. It would be fun to walk through San Francisco and look at places and then see what it used to look like before the famous earthquake. You point at something and the display shows you the old photos. ▲

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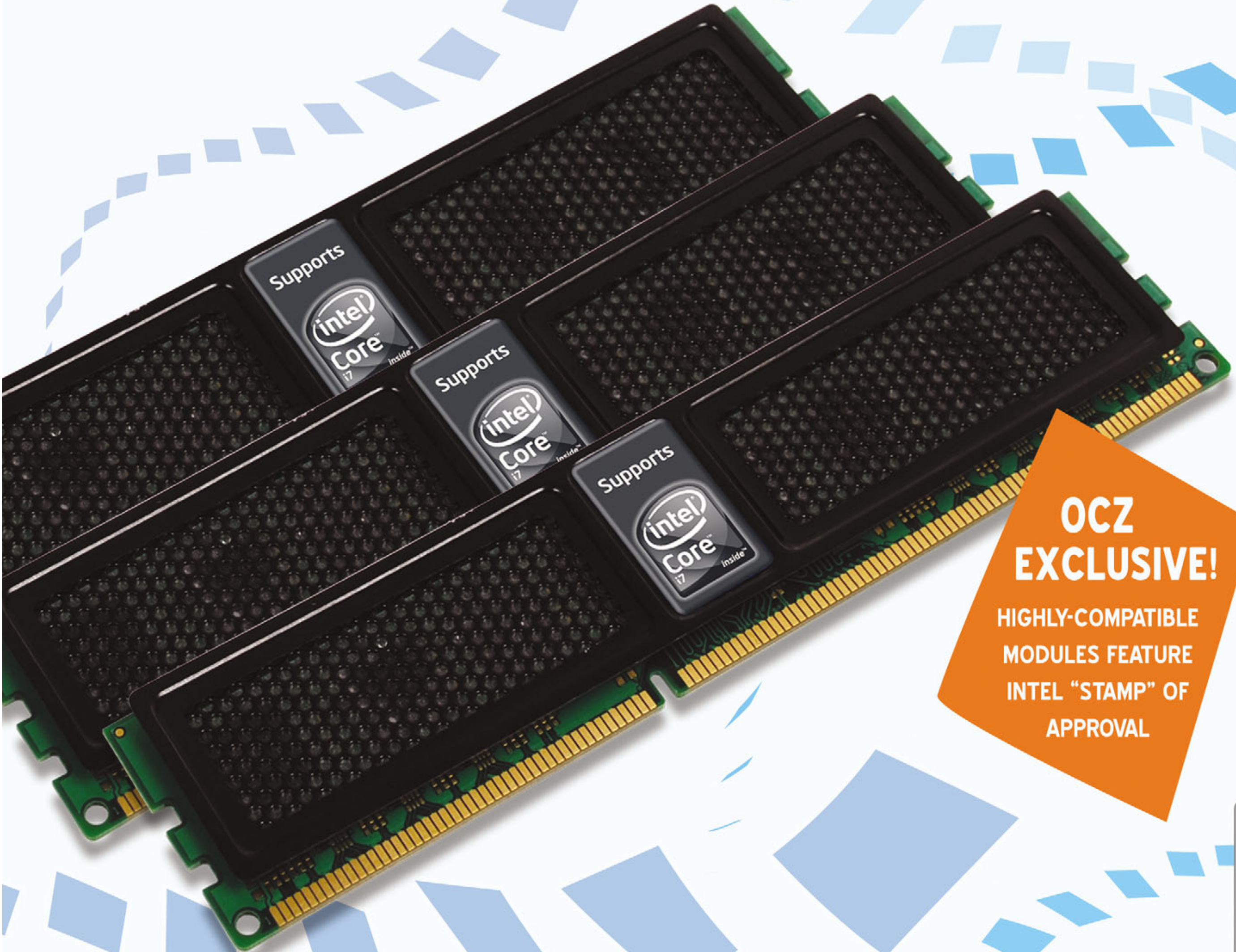

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